

Tentamen Sophisticum

CHEMICAL ESSAY,

Designed to shew the Possibility of applying the Powers of Chemistry to an Examination of several Productions liable to be sophisticated or disguised.

Interspersed with Observations on the approved Qualities of *Ward's Drop and Pill*, *Dr. James's Powder for Fevers*, counterfeit *Magnesia Alba*, and some other medicinal Substances.

Whereto is annexed the Specimen or Plan of a Synopsis, including the chemical Structure, &c. of some pharmaceutical Preparations; and an Account of the Method of trying them for medicinal Purposes.

Nullis cautelis committitur, ut invigilemus, ne, quam in miserrimum saltem Deus dedit in humani generis fraudem, et perniciem, res pervertamus: ut nostris laboribus, et nostris sub auspiciis exalta, utile magis hominibus, et accommoda utantur medicina; nec metuant, ne, propterquam quos ipse morbus habet, molestias addant. Insperam est, ut omnes proficiantur, qui, sub specie ardi, metu et meretricibus oppressis dissipant, et dilacerant: de salute aegrotantium, de aequo et bono, minime solliciti.

Nicholas de Anania Medica.

By EDWARD WALLIS.

L O N D O N.

Printed for the AUTHOR; and sold by Mr. Nicoll, in St. Paul's Church-Yard; and Mr. Robson, in New Bond-Street.

[Price Two SHILLINGS and SIXPENCE.]

ERRATA.

Page	17.	Line	2.	for innert, read inert.
	19.	—	2.	— docmaftic, r. docimafitic.
	23.	—	9.	— is often, r. are often.
	29.	—	22.	— ipecoanha, r. ipecacoanha.
	38.	—	12.	— Mefue, r. Mefue.
	62.	—	19.	— corallaries, r. corollaries.
	67.	—	7.	— affigned the, r. affigned; the.
	85.	—	2.	— the fame, r. this.
	151.	—	14.	— agree, r. agrees.
	159.	—	8.	— of genuine, r. if genuine.

For chryftalline, &c. in different places, read cryftalline, &c.



INTO THE
RIGHT HONOURABLE
THE
Lord BINGLEY.

MY LORD,

THE following sheets were compiled with an intension to contribute my mite towards preserving the individual from future imposition; and I flatter myself the pursuit of a few hints contained in this slight performance may prove serviceable to the community.

An application of chemical truths to the examination of officinal remedies, as they now stand, upon the physical postulatam attraction, has not, that I know of, been offered the public before in a distinct treatise. This is my apology, in part, for the subsequent attempt; and also for the manner of conducting it as a branch of knowledge intirely new.

On the novitiate's account besides, it was found necessary to give a short sketch of the art from its imagined origin, thro' the practice of succeeding ages, to the present time. Hence I have been led into a more circumstantial relation of our general lemma than may
be

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be approved by gentlemen conversant in these inquiries; and I wish it may not have betrayed me into some stale, or inconsiderable remarks, that will discredit the honour of your Lordship's patronage.

But let the design, or my own execution of it, fall ever so short of the reader's expectation; and leave its author exposed to the sharpest reproofs of criticism, I shall have the consolation to reflect, that it has furnished me with a favourable opportunity of giving this testimony of my gratitude for repeated marks of your Lordship's regard.

That you may long live to make the ample gifts of fortune subservient to the offices of humanity; and enjoy the secret satisfaction a munificent heart, uninfluenced by ostentation or resentment, must naturally feel, is the ardent and perpetual prayer of,

My Lord,

Your Lordship's

Most obliged, and most respectful

humble Servant,

York, March 20, }
1767.

E. WALLIS.

P R E F A C E.

CHEMISTRY, which was always in great esteem amongst men of learning, has been long cultivated as a branch of physics. Mons. Huet, a celebrated French writer, who flourished about the end of the last century, was so sensible of its uses in natural philosophy, that he made it, as he tells us himself, a part of his study. * Nec a nobis est neglecta pars ea physicae quam vulgari nomine chymiam nuncupant, quamq; ego naturæ breviarium soleo appellare: mirabiles enim illi, quos in nostro hoc orbe natura edere solet, effectus, eisdem in angustiis spatiis, sub oculis speculantium ars imitatur chymicorum.

In the same light we find it prosecuted some ages before: and though destitute of scientific principles, it furnished the philosopher, whilst a mere art, with data to enforce his conclusions. In medicine, where it was last introduced, and has been most warmly espoused, it has acquired the least applause. Artizans have laudably employed it to promote their several designs, and with good effect: but in medicine we have seen it shamefully prostituted, and sometimes wantonly misapplied.

In-

* Commentarius de rebus ad eum pertinentibus, p. 223.

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Infatuated with that auriferous fumes, which has too much influence upon the actions of mankind, the first intention of pharmaceutical chemistry was soon abandoned for private ends. Hence the business quickly lost ground, and disappointed the flattering expectations that were raised from a consideration of its extent in the art of healing; and its reputation must necessarily suffer more and more, if chemical artifices are not properly discouraged.

From these and other reflections, which suggested the necessity of a reforme in medical chemistry, the subsequent pages are drawn up; and the same reasoning which was of so much service in the speculative part of the art, applied to finish what prior chemists have begun. It has been the chief aim of those gentlemen to investigate the chemical structure of bodies, their several affinities and relations; to demonstrate the cause of different effects observed in the action of the elementary parts of particular concretes upon one another; to explain the reason of these effects; and thence to frame a theory, whereby several chemical phenomena may be rationally accounted for. The design of the present essay is to enlarge these bounds, by shewing how to examine medicinal bodies when formed; to collect some of the scattered hints of authors upon the subject of fraudulent chemistry; and to place them in a better point of view:

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view: to propose a short method of supplying practitioners with proper præcognita for their inquiries on this head; and to point out the best means of preserving persons, unacquainted with the profession, from imposition, where trading chemists betray too much inclination for oeconomy in their preparations.

The least expensive ways of managing chemical productions are indisputably the best: but the art of reducing their value, be it ever so circumspetly or dextrously executed, has nothing to give it countenance; not even the parsimony of purchasers: for tho' frugality may mislead a buyer, whose knowledge of medicine is confined to appearances, this can be no plea for the vender. So powerful, notwithstanding, is the force of custom, that penury or compliance must be the wretched alternative, unless some remedy can be discovered for an evil apparently increasing.

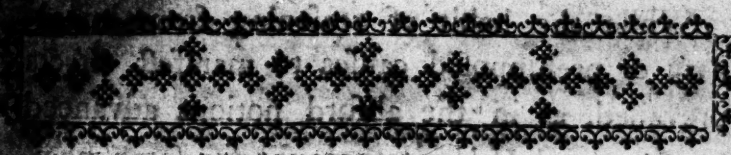
Of this, however, there can be no great reason to doubt, since, amongst the plentiful stores of chemistry, sufficient materials may be gathered for the purpose, not troublesome to select in the course of our reading or practice, with a talent for observation; nor very difficult to bring into order. It may be a business of time, and require attention to casual events; but if our experiments are founded in truth, as consequences

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sequences seem to declare, and the governing principle, or medium rightly applied, whereby the changes of natural substances are effected in the analysis or composition of them, it will want neither much genius, nor great experience to extend the work to a serviceable length, for reasons improper to insert here, as bordering upon anticipation.

In respect to the treatise in general, it may be some excuse, I flatter myself, with an unprejudiced reader, for its numerous errors and defects, that it was both begun and carried on in the hurry of different avocations; and finished in haste, to fulfil a promise which had been over long delayed.

Those, nevertheless, who shall be desirous to remark its failings, from whatever motive, may command my best services; and the language excepted, to which I make no pretensions, it may very probably be in my power to supply them with some useful corrections. The processes are what most readily offered, and the practical inferences comprized in the plan, I hope, not unfairly drawn. As to the rest, it must, with enterprizes of a like sort, expect opponents; and the more capable, whilst the same end is pursued, the better for the public, whose benefit has been the compiler's principal object.



A

CHEMICAL ESSAY.

THE manner of philosophizing amongst
The ancients, upon probable con-
jectures at best, was little more than an
ingenious kind of trifling: And their
method of demonstrating by induction from
scanty data, where numerous particulars are
requisite, but ill calculated to supply fit matter
for drawing general conclusions, or inferences,
to facilitate the study of *Physics*, and advance
the sciences; or, in a word, for framing just
theories. We are not therefore to be surprized
that *Chemistry*, in a more comprehensive sense
than it is usually considered, and the arts im-
mediately depending upon it, should have made
such slender progress as they did, in the course
of five thousand years or upwards, from its
early beginning, to the conclusion almost of
the last century.

A

While

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While the habit of reasoning from imaginary or presupposed causes to manifest effects prevailed, as in the absurd notions advanced by *Linus* and *Hobbs*, to account for some phænomena of the *Torricellian Tube*, or common barometer, which were afterwards refuted by the honourable Mr. *Boyle**, in order to make steady facts submit to fanciful hypotheses, nothing could be reasonably looked for but errors and inconsistencies. And this, it is obvious enough, was in a great measure the case before the illustrious *Newton* appeared: But no sooner was that thick mist which had concealed the beauties and excellencies of experimental inquiries for ages dispelled, by the superior abilities of our incomparable mathematician and philosopher, than useful knowledge began to dawn; when *Chemistry*, as well as other parts of physical learning, reaped infinite advantages from his happy way of elucidating natural appearances, which had long escaped the deepest penetration of human sagacity.

The futile opinions of the *adepts*, who were credulous to a proverb in every thing that tended, however slightly, to countenance the pursuit

* See Dr. *Shaw's* abridgement of Mr. *Boyle's* philosophical works, Vol. 2d, p. 657, 704.

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pursuit of their dazzling idol, declined in proportion to the increase of sound philosophy; and occult qualities, with other conceits of foreign schools, were obliged, after much unphilosophical opposition, to submit to the amazing discoveries of the immortal *Newton*: Whence unexpected light has been scattered upon the whole creation; the productions of the mineral, vegetable, and animal kingdoms have been investigated with greater skill and precision than formerly; the universal affection of matter deduced from indisputable experience; and the art, of which we are now speaking, provided with numerous *postulates* and *axioms*, of singular use in explaining the results of several common processes of the shops, and extending the bounds of *Pharmacy*, beyond the narrow verge of preparations; to a general inquiry into the specific differences of natural substances. Whence too a reason may be assigned for the disunion of their component particles in sundry instances; their natural combinations traced more satisfactorily; the analysis of artificial compositions, of the chemical kind especially, rendered much less difficult; and a way chalked out for unravelling the secret contrivances of the profession, or exposing dextrous sophistications and counterfeits in a concise and determinate

minate manner; so as to answer many serviceable purposes to the *therapeutic* part of medicine.

And in this view the art, however disregarded, seems of as much consequence to the individual as the executive part of it, which though long and sedulously cultivated, as the voluminous labours of *Glauber*, and other specimens of the *Chemist's* works inform us, may nevertheless be called modern, in comparison of *Metallurgy* and *Alchemy*.

Technical Chemistry, which includes the operations upon metals, is said to be coëval almost with mankind. And indeed, from the direct letter of the scripture, it was so far from being looked upon, before the deluge, as an infant art, that it was even said to have been carried, by the antediluvian world, to great perfection. To suppose it therefore of somewhat elder extraction than the *Vulcan** of the heathens, is not totally void of credibility. In a more enlarged sense too, exclusive of medicinal considerations, it appears indisputably, from the concurrent testimony of sacred and prophane history, to be of vast antiquity. But neither

* See *Boerhaave's Chemistry* by *Dalowe*, Vol. 1st, p. 5.

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the brevity nor scope of this design allows me to cite a number of passages, upon the credit of the most esteemed writers, which might be produced in proof of these assertions: Let it suffice then to observe once for all, that this art, however antient, appears to have been cultivated in early times with lucrative intentions, rather than any meaning to extend the limits of useful knowledge; or, since it became a *pharmaceutical study*, to correct the abuses which have brought this application of *Chemistry* into remarkable disrepute with some gentlemen of the faculty.

Necessity, for reasons too obvious to need repeating, inspired the first race of men, undoubtedly, with a desire of exploring the nature and qualities of the different bodies about them, that they might accommodate themselves with the conveniences of life, and make their situation as comfortable, in that rude state of things, as uncultivated genius, quickened by occasional exigencies, could possibly devise.

Hence, without recourse to the words of *Moses*, which make mention of *Tubal-Cain*, or the pagan *Vulcan*, cited before, as an instructor

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of every artificer in brass and iron*, it is not unnatural to conclude that Chemistry, implying a general insight into the works of providence §, as inferred by the celebrated Boerhaave from the writings of Zosimus, must be able to boast an origin equal, if not superior to all others in the circle of arts.

Metallurgy however seems intitled to the preference. But fermentation, or the means of converting saccharine juices into vinous or inflammable spirits, was well understood, we are told by the same inspired teacher †, and in use, as well as several other branches of business truly chemical, long before the infatuated disciples of Alchemy, universally supposed the second class of Chemists, made any considerable figure.

Those cultivators, however, of the less respectable, not probably the least beneficial parts of the art, from their dispersed condition, and other circumstances, it would be losing time to recount, have been either totally neglected, or taken very little notice of by the majority of authors upon this subject. Nay, even where they

* Genesis iv. 22.

§ Διδασκαλίαν πάντων των της φυσικης εργαων, Boer. Vol. 1st, p. 5.

† Genesis ix. 20, 21.

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they have condescended to mention them, it has been commonly in a slight and cursory manner: And though *Chemistry*, considered in its prodigious compass, is allowed to be of the utmost importance to mankind, as being applicable and necessary to *philosophy, manufactures, and the politer arts*, namely, *gilding, enamelling, painting, staining in glass and other bodies, dying, &c.* and even to *military enterprizes*, regretted by *Juncker* in his *Conspectus Chemiæ* *, as well as to medicine and metallurgy, we only meet with three distinct classes of these writers, expressly mentioned upon good grounds, *viz.* philosophical, medicinal, and alchemistical, or “such as search after riches by *transmutations, and the great elixir.* †

After extending itself however beyond that Part of *Asia*, where it was first planted, into *Egypt, Greece, Italy, and Arabia*, from whence, by degrees, it crept in amongst other nations, continually varying its aspect and apparent uses together, our art in process of time made an un-

* *Ars pyrobolica in bellis, &c. superstruitur pulvere chemico pyrio, aut saltem sine eo exerceri nequit. Unde et chemia hodie dominatur in bellis, utpote quæ sine tali pulvere non geruntur, sed dolendus est terribilis abusus.*

Conspect. Chem. Vol. 1st, p. 12.

† *Spratt's History of the Royal Society, p. 37.*

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unaccountable transition, from the reasonable intention of meliorating baser metals, to the extravagant attempt of immediately transmuting them into others of greater purity; and this prospect, delusive as it was, had too many charms for captivated *alchemy* to be resisted. Numbers were seduced, for successive ages, to nourish the vain hope of making themselves masters of the divine secret, or *Philosopher's Stone*, as it is sometimes called, to their utter ruin; no uncommon consequence of airy projects. And it is remarkable here more particularly, that, through all the unwearied endeavours of its disappointed followers for a long series, expecting immense treasure out of every crucible, the only advantages derived from a close pursuit of this notional *metamorphosis*, to themselves or their posterity, after an incredible profusion of wealth, and no inconsiderable waste of time, employed in the prosecution of a thousand chimerical imaginations of the same improbable cast, were a set of hints and experiments, which, though they gave very little satisfaction to these beguiled *adepts*, proved of singular service, nevertheless, in various views, to the rational cultivator of chemical studies: many of which were afterwards
carefully

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carefully collected, and judiciously applied, to different purposes, by persons, to make use of the ingenious Dr. Spratt's words *, who *had only the discreet and sober flame, but not the wild lightening of the others brains*. Some of the warm admirers, notwithstanding, of this flattering species of exalted chemistry, have been so far intoxicated with the fallacious expectancy, as to imagine they were in full possession of the *Grand Arcanum*, or *Tincture of the philosophers*.

In *Zwelfer's Mantissa Spagyrica* † is found the impression of a very large medallion of pure gold, made, this writer assures us with sufficient confidence, of a piece of transmuted *Mercury*; which, to stifle the objections of *Kircher* and others who could not be reconciled, as reasonable men, to the romantic whims of these inflamed *Pyrotechnists*, was procured, he tells us, from the Emperor *Ferdinand III.*—The device, an emblematical representation of the boasted virtues of this tincture, is the head of *Sol*, i. e. gold in the metallurgist's file, upon the body of *Mercury*; whereby, in the same strange idiom, is always intended quick-

* History of the Royal Society, p. 38.

† Pharmacop. Augult. reformat. cum animadversion. &c.
p. 796.

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quicksilver, with the annexed motto; *Divina Metamorphosis*.—The inscription, EXHIBITA

PRAGÆ XV JAN. AO MDCLVIII IN PRÆSENTIA SAC CÆS MAJESTAT FERDINANDI TERTII.

And on the reverse—RARIS HÆC UT HOMINIBUS NOTA EST ARS ITA RARO IN LUCEM PRODIT LAUDETUR DEUS IN ÆTERNUM

QUI PARTEM INFINITÆ SUÆ SCIENTIÆ ABJECTISSIMIS SUI CREATURIS COMMUNICAT: enforced with the subsequent observation: “That

“although the Emperor *Ferdinand*, out of “three pounds of quicksilver obtained but

“two pounds and a half of pure gold by “transmutation, with a grain of the philo-

“sophic tincture, had not the proportion of “*Mercury* over-run the quantity of the tinc-

“ture exactly half a pound, the whole mer- “curial mass would have been transmuted;” *

with a great deal more to the same purpose. And yet a very valuable writer † of our own

time

* Hoc quod coram intueris, numisma, constat ex auro, quod è vulgari mercurio tinctum fuit; cujus libras tres integras ipse FERDINANDUS TERTIUS Imperator, gloriose memorie,

manu propria, in libras duas et dimidiam auri puri, beneficio unius grani tincturæ philosophorum, transmutavit.

Fuissent quidem integræ tres libræ mercurii transmutatæ, nisi tingenda mercurii massa semilibrâ illâ portionem tincturæ superasset. *Id. ibid.* p. 797.

† Vogel, Chemical Professor at Gottingen.

time has attempted, in his compendious treatise of medicinal *Chemistry*, to palliate the matter, and acquit these visionary gentlemen of the general charge of holding it practicable to transform the baser metals, or mercury, usually ranked amongst metals by the antient chemists, with the addition, projection if you will, of a preparation composed for that end, without much, if any other formal procedure, into pure gold or silver: Instructing us that the process, improperly called transformation or transmutation, means nothing more than a method of divesting imperfect metals, or quicksilver, of their impurities †. But this, from the plain letter of the preceding monument, does not seem to have been the full extent of the *Alchemist's* views.

Be that however as it will, philosophy, commerce, and the politer arts, taken notice of before, have been amazingly improved, and the province of medicine enriched, from this fertile

† Equidem summe abscondita, valdeq; incerta est sublimior illa chemia, *Alchemia vocari solita*; ut tamen non ideo commentitia vel impossibilis haberi queat. Nam rude metallum in nobilius transformare; nil aliud est sane, quam liberare illud a sordibus suis adhærescentibus et cruditatibus, atq; ita in tota sua substantia purius vel subtilius reddere. *Institutiones Chemia*, p. 21.

fertile source of imposture, with a number of elegant and efficacious remedies, as well as principles not disserviceable to the speculative part of the science: And though deprived of its share of the benefits much longer than several occupations of inferior consequence, the art of healing availed itself as much at length, if not more than many other employments, of the chimerical machinations of these fantastical adepts. The reason too is evident, for considering the preposterous manner of keeping this imaginary doctrine of metalline transmutation out of the reach of men of moderate talents, by a ridiculous application of metaphors and symbols, we are not to wonder that succeeding *Chemists*, unapprized of the studied obscurity which appeared at last in the works of their predecessors, and thence, of course, mistaking the sense of their allusions, not always indeed the most obvious, should be induced to believe, though erroneously, that most of the remedies, extolled to a degree of improbability by the pompous *Alchemists*, and inserted with such striking marks of approbation, in books of the sublimer *Chemistry*, as could not fail of recommending them to use, were solely designed for medicinal purposes; and consequently applicable to various disorders

disorders of the animal creation. But when the general turn of these writings came to be examined with more attention, some time after the revival of learning, the chief aim of our ideal philosophers was soon discovered to be nothing more in the end, than a design to furnish instructions, veiled in uncommon tropes and figures, how to produce bodies that would most effectually divest inferior metals of their impurities, or rather metamorphose them into others of a superior order, with a view to the enabling them, or, which is more probable, to their being converted into pure gold or silver, without sacrificing much time, or losing any of the substance in the operation*. And this, to make use of their own unintelligible jargon †, is what they seem to intend by the

* See the note above, p. 10.

† Nulli prope modum libri tot verborum monstris, tot perplexis et confusis terminis: et, quod pudet dicere, tot fragmentis pleni sunt, quam quidem chymicorum et alchymicorum opera. *Hoffman Observ. Physico-Chym. Præfat. Epistolaris.*

Ineptiarum, obscuritatis, inaniumq; speculationum omnia fere plena sunt (alchemistarum) monumenta. Et si qua forte veritas alicubi a quaquam detecta fuerit, tam multis tamen tricis oblecta est, ut exquisitissimo judicio opus est, si quis eam invenire velit. *Vog. Inst. Chem. p. 27.*

Chemia! quæ aspera, horrida, laboriosa, à commercio sapientium remota, ignota eruditibus vel suspecta, ignem, fumos, cineres, sordes spirans vix ulla amœnitatis specie commendata habetur. *Boerh. Dissert. de Chymia suis Erroneis expungente, p. 2.*

the metaphorical expression, if I recollect and understand it properly, of *restoring leprous men to perfect health*.

To a lucky misconstruction, nevertheless, of this hieroglyphical language of the *Alchemists*, it is universally admitted, as the celebrated *Boerhaave* observes in his elements *, that we are indebted for the introduction of *Chemistry* into *medicine*. But, by whatever means it found a place in *Pharmacy*, the manifest superiority of chemical preparations over the crowded and incongruous forms, they may be truly stiled, of the *Galenists*, presently indicated the singular utility of the art in this view, and put sensible men upon promoting the study of so serviceable a medical and medicinal acquisition with uncommon assiduity; especially as it seemed to promise relief to their fellow-creatures afflicted with various complaints, whereto mankind are perpetually exposed, from the vicissitude of seasons, the alteration of climates or situation, and a train of accidents and hardships besides, without considering the delicacy of some parts of the human frame in particular, which could not be procured from the best physicians of those days, by their inelegant method of prescribing.

* Vol. 1st, p. 9, by *Dallow*.

scribing. And this new form of practice seems to have been prosecuted, tho' not immediately, with remarkable attention and success. A series of fortunate events, though casual, contributed greatly to raise the expectations of its principal advocates, far beyond their first sanguine hopes. And the astonishing efficacy of these powerful remedies of the *Chemists*, in some inveterate diseases which had long baffled the gentle measures of moderate evacuations, and a few, perhaps *Arabian* compositions, in use before the time of *Basil Valentine*, founded chiefly upon the vague doctrine of the *Peripatetic School*, quickly established the reputation of this tribe of medicines, and banished, for a short period, the elaborate contrivances of the *Galenists*, who were then in remarkable discredit, it is said, among the *Chemists*, as not understanding, or (what is almost tantamount) not being allowed, by a prejudiced set of enthusiastic *adepts*, to understand the most effectual and expeditious means of removing disorders. A knowledge, according to the vain boasts of these hypothetical writers, that could only be drawn from their fantastical labours. *

This

* Ingenio acer, artes doctus ingenuas, eruditione atque facundia clarus, Helmontius, rejectis scholasticæ [medicinæ] chemicæ

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This point of time then, or a little earlier, may be considered as the æra of *Pharmaceutical Chemistry*; and, though not accurately determined, there are several reasons which incline us to acquiesce in the common opinion of its being first introduced into physic about the end of the fourteenth century, when the enigmatical expressions of *Alchemy*, exemplified in the *green Lizard** and *white Eagle*† of Ripley and others, were almost forgot.

From hence it has been cultivated, uninterruptedly, as a material part of medicine, where it has not only flourished ever since, but even engrossed the title in a manner to itself: For the denomination of *Chemist* is seldom or never bestowed, at present, upon any persons, except those who are particularly engaged in making or vending articles unknown to the *Professors* of the *Galenical Pharmacy*, if there were any such amongst the antient physicians in our sense of the term; wherein the active and salutiferous parts of natural concretes are separated from the

micam ita substituit, ut omnis jam Europa nomen illi dederit; hanc omnes uno ore laudare, omnia de eâ bona dicere, quæ sola vitam tueri et salutem posset. Certatim omnes ex arte describere quidquid non haberetur purum putum chemicum.

Dissertatio de chemia suos errores expurgante, p. 29.

* Green Precipitate. † Corrosive Sublimate.

the inert and useless analytically; and other bodies produced for medical purposes, by connecting substances apparently dissimilar or opposite in their natures; from whence arise new medicinal compounds, possessed of qualities indiscernible in one or either of their constituent parts, before they were combined. And the remedies of this class are generally termed *Chemicals*, to distinguish them from another set of officinals, composed of numerous ingredients, not very properly called *Simples*: for none of the natural substances employed in medicine, physically or chemically considered, whether levigated, strained, dried, or in whatever way they are fitted for extemporaneous or officinal uses, can be said to be in an unmixed or elementary state. Witness the casual decomposition attending an injudicious application of one body to another where particular attractions prevail. In tracing the subjects of the three kingdoms it appears, by resolving them into their constituent, though not elementary, particles, that few or none are found incapable of further division. Minerals indeed bid the fairest; and of all minerals the metals; and of all metals the most perfect. And yet there is no reason from a variety of proofs, in the resuscitation of imperfect metals, to conclude

B

them

them unmixed. Amongst vegetables and animals, or any of their parts, the numerous principles, not yet universally agreed upon *, either as to the number or nature of them, sufficiently evince the truth of a doctrine it is incumbent upon me to inculcate in this place: not from an affectation of singularity, in carrying nice distinctions beyond the ordinary rules of more able writers, but as one of the fundamental and necessary postulates of analytical *Chemistry* †. In respect to the common pharmacy however, all spontaneous productions, which make a part of the *Materia Medica*, and are concerned in *Galenical* compositions, may not improperly be stiled simples; for reasons too obvious to persons but slightly instructed in the manner of preparing remedies of this class, to need inserting at large.

Yet

* See *Stahl's Universal Chemistry* by *Shaw*, p. 4.

† Precision in a Treatise of this kind, though no more than a specimen, being requisite, to give the young practitioner some idea of the nature of decomposition, whereon a principal part of our application of the present theory of *Chemistry* to the examination of sophisticated or counterfeit bodies depends; it seemed of consequence to correct the general error of calling spontaneous productions indiscriminately simples, when *Chemistry* tells us they are only simples in respect to the *Galenical* pharmacy: *Chemically* considered, they must be either mixts or compounds, as we shall prove hereafter.

Yet enabled as we are, from the present theory of Chemistry, besides making these necessary distinctions, to investigate the cause of numerous appearances and variations, otherwise inexplicable, and apply them to philosophical as well as chemical purposes; whereby the constituent parts of artificial, no less than natural concretes, and several peculiar properties of their component molecularæ, are made, in some degree, the object of our senses: the *science* of *Spargiry* has no right to arrogate to itself, as it once did, the merit of a more early or superior knowledge of the operations of nature, either in the microcosm or macrocosm, than other parts of medical or philosophical learning: For it must be acknowledged, from what has been already succinctly premised concerning the origin and progress of our art, that necessity and mistake were as instrumental in prompting men to pursue it with medicinal, as doctrastic intentions. Neither does it appear to be a whit less indebted to fortuitous events for its advancement, than the practice of physic or mechanic arts. If we turn our eyes a moment upon the antient state of medicine, both before, and soon after the application of chemical productions to the disorders of the human frame, this suggestion will not appear unlikely in the least.

My Lord *Verulam* observes, in his free censure of the more eminent philosophers, that * by wandering through the wilds of experience, the Chemists have sometimes stumbled upon certain useful discoveries, not by reason, but by accident. And the same thing is likewise remarked by Mr. *Le Clerc* in his *Histoire de la Medecine*, in respect to the first intimations we are said to have received from fabulous or authentic accounts of the virtues of different plants †: whence it may be gathered that *Chemistry*, like medicine, has had singular obligations to chance for a number of useful discoveries, from its earliest institution as a metallurgic art, to its commencing a physical science; a title some gentlemen have lately shewn no inclination to grant, alledging the want of proper principles and precepts. And indeed a modern author ‡, quoted before, seems to have been aware of this objection; for he has prefixed the epithet practical to it, and given it, to prevent cavils, the denomination of a practical science; be-

* See Dr. *Shaw's* Abridgement of Lord *Bacon*, 4to. Vol. II. P. 55.

† Les plus anciens exemples, que nous trouvions, de la maniere dont on a decouvert les vertus de quelques plantes, font voir que l'on en a l'obligation au seul hazard, part I. p. 4.

‡ *Vogel*, Sect. IV. p. 2.

because, says he, it lays down rules for the use of the working Chemist, in his investigation of the nature and composition of mixt bodies; whilst it accounts in a rational manner for its own operations and resulting phenomena.

What advantages may arise from a diligent pursuit of *Chemistry*, agreeable to the comprehensive idea conveyed in the same writer's concise definition of this science*, is not easy to surmise. Certain it is, they must be very considerable, and tend materially, amongst other beneficial discoveries, to open a road for securing the individual in time from many gross errors and artifices, the consequence of ignorance, inattention, or a mercenary disposition, which have sometimes proved extremely prejudicial in the administration of medicine. It is therefore matter of infinite concern to observe, that the same commendable regard for the welfare of the community, which happily promoted an early trial of chemical remedies in different disorders, before the world was thoroughly acquainted with their virtues or respective powers on the animal structure, does not subsist at present; and that the public,

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* *Scientia practica, quæ corporum tum naturalium, tum ex his erutorum mixtionem, atq; quidquid per eam possibile est indagare docet. Vogel, Part I. Sect. I.*

though principally interested in this matter, should not be vigilant and active, in a remarkably delicate and apprehensive age like ours, to discountenance the little stratagems of unfeeling avarice, that shews a readiness, upon all occasions, as the practice of every day demonstrates, to take advantage of the unskilful in these matters; and impose a farrago of adulterate, or counterfeit, for genuine remedies, upon the unintelligent part of mankind, to the almost continual disappointment of the prescriber's salutary views, and the reasonable expectations of the suffering patient. An expedient to become opulent that must necessarily in the long run, if unchecked, defeat the very end and purpose of all extemporaneous and dispensatory forms.

For these, and several other reasons which might be urged, if needful, it is hoped this endeavour to obviate some pernicious consequences of a fraudulent dexterity, too much in use, which cannot fail of being highly detrimental, and sometimes fatal, it is not improbable, to numbers, from what has been already advanced, and will further appear in the sequel, may promise itself a little encouragement from those gentlemen who must, without the proposed

posed assistance, however judicious and experienced, be very frequently obliged to confide in the probity more than parts of a wholesale dealer; where events depend, as they often do, upon the fidelity and goodness of a preparation. Indeed, where integrity is not wanting, the abilities of an operator, it must be acknowledged, is often a consideration of moment: nay, it is hardly conceivable how capital errors should be avoided, in many of the nicer processes of the *Chemists*, without being masters of the necessary *præcognita*, or theory. For if, as Dr. Shaw* very justly remarks, *the Apothecary, liable to be more or less imposed upon, according to his skill and care, by the Druggist, or trading Chemist, is often deceived in these particulars: How stands it with the patient and physician? And what is the state of pharmacy?*

Since then it is evident, without multiplying remarks, that a medicine, though faithfully dispensed, may nevertheless be sometimes deprived, through ignorance alone, of its most valuable salutiferous virtues; it follows, in favour of the practical *Chemist*, that exceptionable preparations should not be always deemed a proof of delusive contrivances. Inacquaintance with the

* Chemical Lectures, p. 195. Lect. xv.

the peculiar qualities of natural substances committed to the management of a common operator, but seldom overstocked, it is to be feared, with speculative notions, which men of meer experience are too apt to reject, or slavishly tied down to college precepts, however authorized, where more frugal methods present themselves, must subject him of course to perpetual mistakes, that seem very likely, on many accounts, to injure the preparation in a singular manner. And, agreeable to what has been just intimated, the committee, appointed by the college of physicians to revise their pharmacopœia, have taken notice in their own narrative, speaking of the exploded method of making Sir *Walter Raleigh's* confection, which though, perhaps, not yet a finished composition, has been very greatly improved, in several particulars: ** That this medicine was contrived near the time when spirituous extracts were first brought into fashion by the Chemists, and were usually compounded with little judgment, being praised without distinction for separating the pure parts of medicines, and reducing their virtues within a small bulk. But all subjects, it is properly noted, and should be religiously adhered to by every preparer of medicines, are not equally fitted for this*

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* *Pemberton's College Dispensatory, p. 114.*

operation. The virtues of some consist of such volatile parts as easily fly off, and leave their extracts an useless mass; others retain a great share of their flavour; in others, again, their medical qualities reside in the denser parts, and those do not only retain their virtues in the extracts, but, &c.

The same reasoning holds good in a variety of chemical productions besides, as well as other preparations of the *Galenists*, it would enlarge this design too much to meddle withal, was there occasion for more facts to persuade us into the belief of what has frequently happened, and is therefore more than probable, though not so much attended to as it ought to be, even now, when medical knowledge is almost become general, and *pharmaceutical* traffic, amongst considerable venders as well as preparers of medicines, regarded as a respectable branch of trade; that a celebrated remedy has gradually sunk into discredit, or been frequently thrown aside, as inefficacious, and the world very often deprived of a well-recommended production, for this reason, which might otherwise, perhaps, have proved a beneficial addition to the present collections of the *British Colleges*: an intimate acquaintance with the chemical structure, and specific differences
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of bodies being as absolutely necessary in several preparations of the simpler kind, which abound in our common formulas, as fit instruments and utensils, to preserve the useful qualities of bodies unhurt, or to prevent their being dissipated. And, doubtless, it is from hence alone we can flatter ourselves with the hopes of being ever able to remove one principal cause of disagreement amongst the curious in these matters, concerning the efficacy or inefficacy of the same medicinal substance, though greatly to be wished: for these disputes, like other contraversies grounded upon conjectures, have seldom produced many significant advantages to the community.

But differences of this sort, it is evident, would be very rare, if the practical and theoretic part of the art went together. And, as observed by an author cited above, ** they should never be separated, being in reality but one effective thing consisting of two parts, viz. previous notion and execution.* The capital offences, nevertheless, in common shop preparations, do not spring altogether from this root.

Unmasterly management, it must not be denied, very seldom fails of producing articles,

* Shaw's Chem. Lect. p. 195. Sect. xix. not-

notwithstanding they may be genuine, of inferior quality; or such as are widely different in their effects from what the physician, who relies solely upon the standard forms of our own dispensaries, has a right to expect: for it is apparent, from what has been premised, that the chief medical property of an ingredient, designed by the directions of the process to be preserved, may be much impaired or altered, if not destroyed, through an indiscreet application of those very means, too incorrectly transmitted to us by the elder *Chemists* especially, which, in judicious hands, would have been conducted in such a manner as to have preserved the salutary virtue of the ingredients intire. A more censurable error, however, of reducing preparations, regardless of events, for the benefit of sale, or to augment the profits of trade, makes a considerable addition to this account.

The great difficulty of previously determining, with any degree of certainty or precision, from the coalescence of two known substances, the medical properties of the resulting compound, is too evident to need an explanation; what then is to be reasonably expected from numerous miscellaneous mixtures of the common chemical operator, but slightly acquainted

quainted with the native qualities of the bodies under his direction, in an uncombined state, and less, it is to be apprehended, with their effects upon each other in an united one? Or, in other words, with the consequences of such a connexion: without running the hazard of a practice not yet altogether out of the question (as will appear by and by) of substituting one ingredient for another; where the active principles and virtues of both, or either of the combined bodies, are merely guessed at, or perhaps totally unknown.

Under such circumstances it must be impossible, from the most perfect practical knowledge of chemical operations, to predict the medicinal properties of the new concrete, and bespeaks an absolute disregard of consequences whenever this abuse is ventured upon. The constituent parts of sundry substances, frequently repugnant in their natures, as alkalies and acids, from whence different saline concretes of the neutral kind are produced, may very powerfully counteract, or otherwise affect one another; and in a manner too which cannot be ascertained by the help of the most rational principles, without a series of observations closely attended to, and warily pursued: their

their respective salutiferous qualities being hence considerably varied, or other virtues acquired, in consequence of a new coalition, diametrically opposite, I was near asserting, to those experience had discovered in them before they were connected together. And this is observed to take place, as well in some mechanical mixtures, or galenic compositions, as in a multitude of chemical combinations. Opium, which frequently causes very disagreeable complaints in particular habits, if uncorrected, or given singly in a crude state, is surprisingly altered in its effects, by an admixture of the root of white hellebore, and the known virulence of this drastic vegetable is likewise mitigated, in its turn, by a suitable addition of the narcotic substance, instanced in Mr. *Ward's* fudorific powder for rheumatisms, and some other remedies of the same tribe. Though this doctrine is not to be extended to the emetic quality of *ipecoanba*, for reasons assigned by the learned Dr. *Akinside* *. The griping or purgative virtue of the peruvian bark, administered as a febrifuge, to some constitutions where opium, and its preparations, have been generally observed to occasion watchings, startings, and other unpleasing symptoms of the same kind, is successfully

* De Dysentæria.

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cessfully restrained, when it happens to affect the bowels after this manner, by the addition of a few drops of liquid laudanum, without the least inconvenience from the opiate. Fine silver, of itself an innocent insipid mineral, is changed, by its proper menstruum, a nitrous acid, into a dangerous active salt; or being inspissated to dryness, and melted afterwards into a very severe caustic substance, of an intolerably nauseous bitter taste. *Glauber's smoking spirit of nitre*, as it is generally called, which bursts into flame, if poured upon some particular essential oils, as cloves, cinnamon, saffrafras, &c. is convertible into an useful culinary, or medicinal salt, by the coalition of a fossil or vegetable alkali, while the same vegetable alkali, acuated by a commixture of the salts of lime, esteemed, in their uncombined state, by Monsieur *Le Febure*, the late ingenious Dr. *Whytt*, and many physicians of eminence, a powerful lithontriptic *, acquires hence

* Lime water, constituted of the salts of lime and water, it has been lately observed, has no effect on the blood as lime water, but as liquid shell; which makes a new compound in the blood, and as such can never dissolve the stone in the bladder, but as this compound proves diuretic; this, however, occasioning a greater quantity of warm water to be thrown upon the stone than usual, it is allowed, may have some effect, because a stone exposed to warm water may be dissolved in time.

hence a remarkably caustic virtue, evident in the causticum commune, or lapis septicus of the shops. *Magnesia Alba* likewise, in high vogue, and deservedly, at present, for reasons unnecessary to urge here, supplies us with another instance of the truth of the foregoing position, and more applicable to the main design of this essay; as being better calculated to evince both the danger of sophisticating medicines, and of substituting one medicinal substance for another.

Tho' this gently opening, absorbent earth, it is known amongst *Chemists*, has of late been much less frequently adulterated than counterfeited. Since fallacies of both kinds however are but too commonly put in execution, it will not be amiss, for the sake of mankind, to mention the different effects of these several contrivances; in order to furnish purchasers of this preparation with necessary cautions, and to throw a little more light, at the same time, upon a subject that merits the attention of the practitioner no less than the patient.

The salutary or pernicious consequences accompanying the use of this celebrated remedy depend essentially, when properly administered, upon its being genuine or spurious: where it
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is to be remarked, by the way, that one of the spurious kinds, of which three are well-known, cannot be applied medicinally, even to adults, without prejudice, under any circumstance of disorders arising from redundant acidities: for it acts like a slow poison, confining the noxious acrimony, unaltered, in the intestines; from whence these complaints, which owe their origin to sour humours, must necessarily be much aggravated; and convulsions, with other alarming symptoms in the delicate frame of infants, occasioned, in consequence of taking a selenitic substance, in lieu of *Magnesia Alba*, as will be shewn hereafter: while the genuine medicine, though inelegantly made, is endowed, in part, with the power of correcting acidities, in the first passages particularly, by absorption; whereby it constitutes, in conjunction with the natural acid, a moderately cooling and opening salt, not totally dissimilar to the famous *sel de saignette*, or *Rockelle salt*, composed of a vegetable acid and a particular alkali *soda*, different from all others of the lixivate kind; but much more nearly resembling the common purging salts of the shops, as they have both the same base, the best *Magnesia Alba*, made for sale at present, being procured universally from this saline substance, generally described

described under the title of *Epsom* or *Magnesia Glauber's salt*, instead of the elaborate and expensive preparation of *Lancisi*, from the mother liquor of nitre; and with some advantage: for the present process is more expeditious, as well as less chargeable; and the medicinal effects of the *Italian* production superior in no respect to what is now produced by decomposing the bitter salt of the pans: from whence we must observe, by the bye, that the mineral waters of *Soarborough*, and other medicinal springs, seem to be furnished with part of their purgative powers.* This medicine, however, the author of the institutes of experimental Chemistry has called an *impediment upon the public*, and censured the present method of making *Magnesia Alba* undeservedly, as a chemical artifice: though he is pleased to tell us, a little after, *with respect to the virtues, there is no difference that can make*

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* That it is this salt which gives a slight purgative quality to mineral waters in general; to common sea water; and to brine-springs, such as *Harrowgate*, *Thorp Arch*, &c. is evident from an analysis of the salts obtained by merely evaporating the water of these wells, and setting them in a cool place to crystallize, &c. For, baring the sulphureous or fetid smell of mephitic purging springs, where metals have no share, their chief contents appear to be calcareous, or mild absorbent earths, and mineral alkali, sometimes united with a muriatic or vitriolic acid.

† Vol. I. p. 363.

† Id. ibid.

the substitution very condemnable. And truly it is to be wished there were not any *more* culpable frauds in the profession of *Chemistry*; for except it be shewn that any of the virtues, ascribed by *Hoffman* to his *Magnesia Alba*, are wanting in ours, which is not highly probable, (without touching upon the ingenious Dr. *Lewis's* observation*) there can be no offence in the substitution.

And, notwithstanding the conjectures of some intelligent writers upon this subject, who have taken considerable pains to prove the *medicinal Magnesia* deobstruent and laxative in itself, there is the greatest reason to suppose it owes, as well its *aperient*, as its solutive property, mentioned by different authors, in the strictest medical acceptation of the term, to some coalition of the like sort, in an inferior degree, as where the redundancy of four humors perhaps have been trifling in the first passages; or else to a small proportion of enixed salt remaining in the medicine. Mr. *Glass*, a gentleman of *Oxford*, has ventured, nevertheless, to offer it in the light of an opening substance, inconsistently almost with his own doctrine: for though

* See Dr. *Caspar Neumann's* Chemical Works, by Dr. *Lewis*, M. B. p. 190, in the notes.

though we are told in one place, what repeated trials have evinced, that the purgative virtue of *Magnesia* absolutely depends on its union with an acid only, as may be experimentally demonstrated.* It is said in another †, that *persons in the meridian of life, those at least who are blessed with a good constitution, are seldom liable to the diseases which are the portion of lax habits and weak viscera. From the strength of their digestive faculties, they are able to subdue and assimilate the various kinds of aliment into one and the same homogeneous nature; and though acids be conveyed into the stomach, they will not long retain that quality. Hence, as no acrimony of that kind will exist, Magnesia can no otherwise be of service to such persons than as an occasional remedy, either to cure the heart burn, prevent costiveness, or empty the intestines.* We find it accordingly recommended in public advertisements, and printed directions, as an infallible cure for habitual costiveness, without restriction; notwithstanding its *aperient* property, in the nicest sense of the word, as hinted before ‡, is to be much suspected, when in the utmost perfection, or greatest purity; whereon its excellence, as an opening absorbent intirely depends. Unless it meets with a fit por-

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* See Mr. *Glass's* Essay on *Magnesia*, p. 35.

† *Id. ibid.* p. 23.

‡ See the preceding page.

tion of four humors wherewith to unite, no sensible effects succeed; for which several reasons, besides what have been already urged to enforce this argument, might be offered, were it not wholly out of course, in a pharmaceutical treatise of this kind, to trespass upon the superior province of physicians.

But should calcareous or cretaceous earths be mixed, in any proportion, with genuine *Magnesia Alba*, though as an absorbent it may still have a salutary influence on the disorders of infancy, or adult age, arising from a redundancy of four humors affecting the stomach or bowels; the solutive property, which solely depends, we find, upon its union with vegetable or mineral acids promiscuously, must nevertheless be lessened, destroyed, or reversed, in some measure, by the counteraction of testaceous or other earthy substances, superadded to reduce the price of the preparation, without paying any regard to the consequences of such an adulteration.

And yet these inconveniences, great as they are, seem nothing, in a manner, when compared to the injuries that must inevitably follow the liberal application of a counterfeit *Magnesia*

nefia Alba, most in use at present; where, instead of a remedy happily calculated to obtund a predominant offensive acrimony; and to exonerate the bowels of their morbid contents, which unadulterated *Magnesia Alba*, judiciously prescribed, very seldom fails of effecting, a constipating selenites is administered, that is incapable, from the very nature of the concrete, to correct or diminish prevalent acidities in any respect; being a neutral substance, made by the coalition of a gypseous or cretaceous earth, and vitriolic acid. It cannot therefore be analysed, or altered, by the affusion of any acid of the same, or of an inferior order, as experiments demonstrate; although the component parts of this substance may be disunited by proper means.

And to confirm what has been premiffively urged upon this occasion, the gentlemen of the committee, referred to before*, have taken notice generally, in respect to the *Galenical pharmacy*, that one great error must obviously appear to run through the whole of the antient system: that is, redundancy in composition. This, when physick first became an art, it is urged, could

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* Dr. Pemberton's English Dispensatory, p. 3.

scarce be avoided. While experience was short, and the powers of medicines could not be exactly known, then it was natural to accumulate ingredients of similar virtues, while it was uncertain which deserved preference. But this practice was attended with two great disadvantages: for, without very singular care, discordant ingredients, that would obstruct each other's operation, must be often combined together. Whence it has frequently happened, there is no dispute, in the compositions of Mesne, Rhazes, Avenrhoes, Avicenna, and others, before Chemistry was introduced into medicine, that a principal intention of the composition has been wholly frustrated, or the salutiferous effects of a particular body diminished at least, by the opposite quality of another ingredient, which seemed to promise, from the nature of the substance, some considerable advantage to the new medicament.

And sophisticated or fictitious *Magnesia Alba*, conformable to the preceding doctrine, experience informs us, is never possessed of all the properties of the genuine preparation; sometimes with none of them. This last observation, however, it is to be remarked, takes place in the counterfeit sort alone: As to the rest, their aptitude to acquire a solutive property, when combined with acids, can be only so far counteracted, by a proportion.

portionable addition of different earthy astringents, as to make them binding, rather than opening absorbents. But in the more blameable artifice of imposing factitious selenites for *Magnesia Alba*, a costiveness is induced, without correcting any four humors which may affect the alimentary canal; not unlike what is sometimes observed in drinking the hard water of particular springs, from the chrySTALLIFORM concretions of gypseous matter wherewith they are impregnated.

Hence we are supplied with a reason why the severe disorders of children, arising from this cause, far from being remedied or relieved by such an unpardonable abuse, must be necessarily augmented or prolonged; and one of the most valuable substances *Chemistry* has produced for ages, in danger, besides, of being discredited, by reason of the supposed incertainty of its effects; which, if honestly, though not very elegantly prepared, as noted above, are invariable, except in the measure of their opening or absorbent powers; and these are always proportioned to the purity of the substance, as may be proved from innumerable instances in the use of *Magnesia Alba*, amongst adults as well as infants, where the general consequences of indigestion, attended with acid eructations, and
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other symptoms of the like sort, indicate its application.

Another example, to the same purpose, is recited by the ingenious *Hoffman**, in the sophistication of vegetable distilled oils; remarkably prejudiced, our author informs us, by chemical frauds, “ This diminishes their
“ strength, and impairs their medicinal virtues
“ together; nay, frequently supplies them, it is
“ known, with qualities very different, though
“ not the most desirable, from those experience
“ had discovered in the genuine essences.” But indeed the various facts which offer, in a moment, upon recollection, to evince the general bad custom of mixing or otherwise reducing medicinal bodies, are too numerous to insert; and totally unnecessary, if not improper, to particularize, where brevity is a principal object, and enough, it is hoped, has been said already, to caution gentlemen, concerned in the constant administration of medicines, against making use of counterfeit or sophisticated remedies of any kind. It may not be amiss, notwithstanding, to remark, once for all, that deceptions of this class, insignificant or trifling as they may seem, very probably,

* *Observ. Physico-Chymic. Lib. i. Obs. 2. p. 12.*

to transient observers can hardly fail, to say no worse, of being followed with many disagreeable consequences to the cultivation of physick in every view, except the use it is applied to at present, of shewing the dangerous error of substitution in general; and of exposing a few of the numerous mischiefs that threaten an ill-placed confidence in the pretended discoveries of catholicons, or universal and infallible remedies, promising to restore lost health and vigour, *with God's blessing* *, in a short time, without understanding a tittle of the circumstances necessary to be regarded in chronical as well as acute disorders, where the patient's safety makes a part of the consideration; and where, for want of due attention to incidents, these boasted panaceas have too commonly proved exceedingly prejudicial, and sometimes fatal, it is to be feared, to the disappointed purchaser. Nor is this to be wondered at in the least. Narcotic and metalline bodies make up almost half the catalogue of our most celebrated quackeries; and these, it is well known, cannot be administered with too much circumspection, especially the latter, to weak viscera and lax habits; whence indigestion and its train of miserable effects. For, under the circumstances

* A cant expression in quack advertisements.

cumstances of redundant acidities, inseparable companions almost of very infirm or worn-out constitutions, an imprudent application of *Ward's Drops*, *Maredant's Tincture**, and even *Hooper's Female Pills*, may occasion complaints no physician can well remove. This may be collected in part from the subsequent observations, thrown together just as they offered, in order to illustrate a truth of too much importance to the practical part of medicine to be dropt in silence.

That the approved qualities of all saline substances, medicinal or deleterious, are evidently more indebted to their bases or firm parts, than to the acids wherewith they are respectively united, cannot be contraverted. The chrystals of silver, red precipitate, falsly so called, cubic nitre, verdegriis, ceruse or white lead,

* A lady of an infirm constitution, and past the prime of life, being afflicted with an obstinate scorbutic disorder, which had baffled the repeated attempts of a rational practice, made use of this tincture according to the printed directions, and was thrown into a severe salivation, which carried her off in about three weeks: though we are told in these directions and some periodical papers, that "this medicine may be taken by women
"with child, and persons of the most delicate constitutions, for
"fifty years together, without the least injury; and at any
"season, without the least inconvenience or hinderance of business."

lead, and the neutralized volatile salt of the *Edinburgh Dispensatory*, seldom seen in a solid or crystalline form, are eminent proofs of this fact. For although two, or perhaps three, of these substances are truly medicinal, the rest may be justly ranked amongst poisons. But the first three, viz. silver crystals, red precipitate, and cubic nitre, are formed by a coalition of good nitrous acid with pure silver, running mercury, or a marine or fossil alkali; the rest to a combination of that mild vegetable acid vinegar, with copper, lead, and an animal salt respectively; whence verdegris, the white lead of the painters, and *Mindererus's* febrifuge spirit, esteemed in prescription, by some gentlemen of the faculty, a preparation of equal, if not superior value, in particular habits, to *Riverius's* celebrated saline draught *, for feverish disorders. And the famous *Juncker* † takes notice, that spirit of sal ammoniac and vinegar, as a menstruum, compose a mixture which, though nearly void of taste, is, nevertheless, endowed with some not despicable qualities. While on the other hand, to corroborate what has been premised, it is to be noted, that neither mineral nor vegetable acids make any such

* The common febrifuge draught of the shops.

† *Conspect. Chemiz*, Vol. I. p. 230

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such material alterations in the properties of different saline bodies, which owe their constitution to the union of these several acids with the same fixed alkali, or lixivate salt, instanced in abundance of chemical preparations; as vitriolated tartar, regenerated nitre, *Sylvius le Boe's* digestive salt, and foliated, often called (though not the most properly) regenerated tartar; as not bearing any resemblance to the natural substance it is here supposed to imitate: besides other objections which might be raised to shew the great impropriety of a name that has been changed of late by the college, for substantial reasons, to *sal diureticus*. Now the above substances have each of them an incinerated salt for their common base, and being saturated or neutralized by very different acids, become medicinal bodies, tho' but two of them are in use, assuming different figures, if not different virtues, from the acids wherewith they are combined, whether vitriolic, nitrous, muriatic, or vegetable. Iron and tin likewise, judiciously corroded, or converted into chrystalline concretes, by any of the preceding acid solvents, become very serviceable remedies; while the more perfect metals, especially gold or silver, which contain no se-

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perable phlogiston or arsenical principle, and are supposed, from that consideration, incapable of being reduced to calxes, may, notwithstanding, be changed into poisons remarkably virulent, by suitable *menstruums*; whence one might be led to conjecture something, not very improbable perhaps, concerning the nature of these substances, with respect to their combination; and how far the celebrated *Vogel* and *Becher*'s opinion, relating to the common arsenical principle of metals and metalline bodies, may be considered as the cause, in part, of the deleterious property of several metallic substances void of malleability, from a redundancy of this arsenical body; and whether the same pernicious property is not owing, in some sort, to the existence of the same noxious mineral, in the most ductile metals, when corroded.

Hence, however, it is demonstrable that the specific properties, activity, and opposite qualities of the factitious substances just mentioned, arise principally from the different solids where-with they are severally connected; though it is not to be denied that an enlarged proportion of the same acid will increase the activity of the same solid, and render its operation much more powerful.

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This appears almost unexceptionably in the dangerous effects of Mr. *Ward's* scorbutic or white drop, and the corrosive sublimate of the shops, which have a great analogy to each other. The violent operation of the former, notwithstanding Mr. *Page's* account of its extreme mildness*, and other reasons foreign to the purpose of the present treatise, seem to favour our supposition. For Mr. *Ward's* preparation turns out, upon duly considering the process, to be little if any thing better than a solution of the salts of mercury, *i. e.* a combination of mercury and nitrous acid in rose-water. The small quantity of quicksilver required to saturate this extraordinary solvent, in comparison of what may be dissolved in good aqua fortis, is a proof that the menstrual power of the acid, or its tendency to unite with quicksilver, instead of increasing, is considerably diminished, by the addition of *volatile alkali*; so that the large mercurial mass, obtained by evaporation, as the receipt directs, appears to be a mixture of mercurial chrystals and true nitrum flammans, which are afterwards dissolved, as mentioned

* This medicine, thus rendered extremely mild, cannot possibly be accounted dangerous; seeing that, in the dose of *two drops*, usually taken in 24 hours, the quantity of mercury does not amount to half a grain. See Mr. *Ward's* receipts, by *J. Page, Esq;* p. 17.

mentioned before, and passed upon the world for an amazing discovery. Will it not, otherwise, be difficult to assign the reason why a pound of aqua fortis, prepared after Mr. Ward's manner, should be saturated with four or five ounces of crude mercury, whilst, in pure aqua fortis, the necessary proportion is nearly equal? * Mercurius dulcis likewise, and what was formerly called calomel†, which consists of corrosive sublimate, and an addition of running mercury, repeatedly sublimed, may be administered in doses of a scruple or upwards, without any injury; whilst a single grain of white corrosive mercury will sometimes produce very dreadful effects: whence it is demonstrable, that the poisonous or virulent property of unbridled sublimate

* Ad unam partem mercurii non plus quam $1\frac{1}{2}$ pars aqua fortis bene requiritur. *Junker's Conspect. Chem.* Vol. I. p. 344.

Macquer, Newmann, and indeed experience, carries it further.

† Acidum salis communis cum mercurio violentissime corrosivum exhibet. Cujus causa manifestò residet in largiore acidi hujus in mercurio sublimato adnatione, quam primum enim illud novi mercurii additamento debite accrescit, fit corpus infigidum* seu dulce, ut vulgo appellant. *Id. ibid.* p. 208.

* Q. Has not mercurius dulcis, as it is called, a brassy, vitriolic, or styptic taste? And will it not, if pressed upon the tongue, destroy the sense of that organ, for a while, by its astringency?

See Sir John Floyer's *Pharmaco-Basanos*, Vol. II. p. 408.

limate is considerably blasted by the same addition of quicksilver, and a separation of some part of its acid salt, found in the neck of the bolt-head upon every sublimation. Iron filings also, the late ingenious Dr. Whitt* takes notice, act variously, according to the quantity of acid in the stomach or bowels, according sometimes, especially in delicate constitutions, a disorder in the first passages. Hence we are supplied with a reason for prohibiting the use of vinegar, and eager liquors in general, to delicate or broken constitutions particularly under a course of mercurial or metalline substances, liable to corrosion from slight vegetable acids. A circumstance of no slender consequence to the prescriptive, as well as the dispensing, part of medicine in different views. For it indicates the offence and hazard of a random substitution, too much in fashion amongst the pharmaceutical tribe of compounders, from a supposed similarity of power in bodies of similar appearance, and enables us to expose the dangerous practice of using general, or rather universal remedies, for so in fact they are, if we rely upon the pompous boasts of their proprietors, or the vendors of them, without any better advice than general directions afford.

Besides,

* On nervous disorders, p. 242.

Besides, it teaches us to account, in a more satisfactory manner than could be otherwise expected, for the uncertain primary operations of Mr. *Ward's* pill, Dr. *James's* celebrated febrifuge powder without mercury, and some other antimonial preparations.

The first doses of these drastic remedies usually act, it is well known, with remarkable violence in the primæ viæ; inducing severe vomitings, or else passing off, in sharp liquid stools, by the bowels.

Now Mr. *Ward*, who never pretended to be extremely conversant in the reason of things, though vain to a proverb of the miraculous effects of his *panaceus*, vauntingly ascribed these accidental operations, for they were variable and inconstant, to a peculiar virtue of exerting their influence on the peccant humors alone, without any eye to the disposition of them: and thence happily relieving oppressed nature by the more sensible discharges in a little time. But from a confessed precariousness of the events, these effects appear rather due to a casual combination of the *reguline* part of the antimony, (wherein stibium principally abounds) with a suitable proportion of four
D humors,

humors, prevalent in the stomach or intestines of weak or decayed habits, which are apt to breed crudities. Whence, and whence only, an active saline substance, possessed of the express qualities of *emetic tartar*, is instantly formed, as the consequences discover.

For it is an undeniable fact, that "metals, and metallic substances, do not act in the body, unless altered by some menstrual power;" but in a state of solution or corrosion, even *aurum fulminans*, though highly esteemed by some *as an internal remedy, cannot be safely given, unless it has been first well washed from its salts, and does not meet with a suitable acid solvent in the stomach; for in both these cases they may have dreadful effects; of which, it is said, there have been remarkable instances.*

The same, or consequences similar to those already remarked of Mr. *Ward's* pill, which is nothing more, according to Mr. *Page*,† than glass of antimony and dragon's blood, are observed in the taking of Dr. *James's* powder for fevers, as hinted by himself; and seem to be capable

* *Shaw's Chem. Lect. p. 235.*

† See receipts for preparing the principal medicines made use of by the late Mr. *Ward*, p. 7.

capable of a more rational solution upon these than any other principles, without entering into a mechanical explanation of the sensible effects of either.

And hence it likewise appears, at the same time, as tho' some conjectures, not altogether groundless, might be formed, which rather tend to discountenance than encourage the substitution of emetic tartar, and chelæ cancrorum; or the ingenious Dr. *Huxham's* essence of antimony, instead of the celebrated fever powder in chronic complaints, or by way of an alterative remedy, where the officinal preparation is to be depended upon; which, by the bye, is not always the case.

When made of an inferior crocus metallorum, *emetic tartar* will not answer any curative or quick operative intention, as might be indisputably shewn if necessary. But a digression of this kind, was it in course, would take up more time than can be spared for mere speculation, though the subject supplies an endless variety of useful hints, that promise infinite advantage to the art of healing; and are capable of being pursued with great prospect of success by persons duly qualified for such abstruse

researches; were they assisted with proper processes and experiments for the business, as appears irrefragably from repeated observations of several ingenious gentlemen of the faculty*, and a few scanty opportunities chance has afforded me of making some remarks on this head.

To return therefore to our subject. It will scarcely admit of a question, from what has been premissively advanced, that a chemical operator, unconvertant with the elementary part of the science, must be perpetually disappointed by unexpected accidents, the result of mere natural powers, and commit many mistakes of consequence to the medicinal intention of his preparation: insomuch that it is matter of astonishment, considering how liable we are to miscarry in the management of a process, from very trifling errors or oversights; and to fail of due perfection in the production of a remedy, that so little care should be taken to prevent an increase of artifices, employed at any risque, to reduce the value of an efficacious medicine

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* See Dr. Baker's inquiry into the merits of a method for inoculating the small-pox. *Hoffman* upon the subject of antimony, &c.

The practice indeed has been long stigmatized; but the general reproach has not yet answered any material end: and it is to be apprehended the public, who have an interest in the probity and adroitness of the working chemist, will hardly reap many signal advantages from reiterated strokes of sarcastic wit, or the conscientious suggestions of humanity. How far they may possibly avail themselves of a well-established jurisdiction, for inspecting and punishing offences of this complexion, exercised at present with impunity, can be only determined by trial. And an experiment of this kind, methinks, is worth attempting, as there can hardly be a more unpardonable abuse, or one that calls more loudly for the eye of authority, than counterfeiting or adulterating substances, whereon the lives, it is not improbable, or future welfare of numbers almost continually depend. And where, to say more, the strictest attention and integrity are often found insufficient to make good medicines answer the curative intentions of an experienced and judicious prescriber. For it is evident, from the testimony, of our own senses, and the practice of ages, that, however honestly and skilfully prepared, the best preparations are, in too many cases, but uncertain applications.

One of the chief aims, therefore, of the present performance is to evince a possibility of obviating the capital inconveniences arising from an inexperienced or fraudulent exercise of *pharmaceutical Chemistry*, not hitherto discountenanced as it ought to be, by the help of some short intelligible rules, deduced from the speculative part of the science, and a knowledge of the genuine constitution of the substance; and for examining different officinal productions of the chemists, without much trouble; from whence the manifest disparity between sophisticate and unadulterated medicines may be discovered in a variety of instances.

Hence, then, attempted as it is for the service of the community in general; but particularly, and more immediately, for the benefit of extemporaneous dispensers, or prescribers of medicinal substances, there is room I hope to flatter myself, without incurring any imputation, that an enterprize of this necessary kind, however short of perfection, will not be totally unacceptable to the bulk of medical or medicinal readers, who have the good of their fellow creatures at heart; nor its author, however unequal to such a task, denied the slender merit of having endeavoured to give some outlines !

lines of a plan for securing retailers, as well as others more nearly concerned, from the fraudulent attempts and impositions of common trading chemists; and thereby, perhaps, frequently preserving persons reduced to the necessity of applying for relief in their respective disorders, without consulting the skilful in these matters, from a train of mischievous consequences, incident to medicinal error or artifice; not so easily discovered or detected, nor the events, of course, so very readily foreseen by practitioners of moderate experience, as may be generally imagined, unless previously acquainted with the natural or artificial structure of medicinal substances, and the alterations induced by new combinations or decompositions; which often divest many of them, as observed before*, of their original virtues, and furnish other qualities, noxious or salutary, widely different from those which had been previously discovered in either of the compounding parts of the bodies united for medicinal purposes.

“Suppose all the elements could be separated, say the chemists, no judgment could be rightly formed from thence, of the properties of the com-

* Pages 29, 30, and other parts of this work.

compound made by their combination; for they do not chemically depend at all upon the elements themselves, but upon the combination of them. In mechanical mixtures we may generally form some reasonable conjectures; as the constituent parts retain their own peculiar properties, in most case; but have not always the same effects as before they were compounded."

Nor is this all. For, granting a composition dispensed with the utmost fidelity, we are sensible, from what has been offered already, that it may be faulty on other accounts. It is therefore intended, if not prevented by unforeseen accidents or avocations, to consider the whole of medicinal composition more at large hereafter; when the purity and perfection, as well as the genuineness of each officinal remedy capable of examination, by comparison or otherwise, will be made an object of our inquiry.

And notwithstanding the universal utility of a work of this kind, should it ever be completed in a masterly manner, is not to be disputed, nor its reception questioned; there is too much reason to apprehend a slender attempt like ours, which only presumes to shew the possibility

possibility of applying chemistry to the particular purposes of examining its own preparations, however material it may prove in the end, will hardly be well received at first, unless fortunate enough to conciliate the protection of a few respectable characters in the medical or literary world, whereto the author is conscious it has not any high pretensions. It consists of little else than a collection of hints, dispersedly touched by other writers, and now thrown somewhat nearer together, for the sake of giving the reader a more distinct view of the matter; in hopes this new branch of chemical analysis, principally comprizing the examination of sophisticated substances, may be formed in time into a complete system. Its principal merit is perhaps the novelty of the application, which a few occasional experiments in the common course of business suggested, how appositely must be submitted to more competent judges; and left room to suppose the practicability of disuniting and connecting a number of artificial concretes, or of otherwise bringing them to the test, and giving each their true chemical characteristic, was not altogether a *chimera*. But that genuine substances might be hence frequently distinguished from counterfeit or adulterate, and an easy method laid down for
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procuring unexceptionable preparations with tolerable certainty from wholesale dealers, whose traffic generally comprehends invaluable as well as valuable articles; as the ingenious Dr. *Lewis** has already done, in part, with many natural substances made use of in medicine.

Numbers, it is easy to presage, from the title of our Essay, will have a singular pleasure in shewing their disapprobation of it whenever an opportunity offers; and be less assiduous, it may be doubted, for good reasons, to impart their sentiments candidly on the object, end, or execution of it, than to enumerate its errors, or deride the author's extravagance, who has engaged in an undertaking, apparently absurd, that promises to offer a plan, whereby the progress of medicinal artifices may be retarded, if not the practice suppressed, without "laying the elaboratory open, or revealing the secrets of modern chemistry," as an anonymous writer expresses it.

But experience informs us, it is not remarkably inconsistent with the known business of pharmacy, as things stand, to suppose a necessary criterion of genuineness, in several bodies
capable

* See his *Materia Medica* in various places.

capable of being sophisticated or counterfeited, may be found, from an acquaintance with their elementary parts when compounded; or from some distinguishing property existing in those of a more simple nature, which do not admit of an immediate decomposition.

To compleat this enquiry, however, in a philosophical manner, whence the cause of these results may be fairly traced, there will be occasion to make use of a physical postulat-um, adopted too hastily, when *experimental philosophy* was first properly cultivated; and therefore not very happily applied by the ingenious Dr. Friend, from the celebrated Kiel's propositions, to the solution of some known chemical *phenomena*: Hence too much room was allowed for disputants to declaim on the vanity of conclusions unavouched by facts; and for practitioners to question the truth of an assumption which had failed, for want of due restriction, in the hands of the divine Newton himself, as will be shewn hereafter.

And it must be admitted, that, notwithstanding the mistakes of these gentlemen, in taking the philosophical postulate attraction in too large

a sense, and extending it indiscriminately, to the operations of the molecular of particular bodies upon each other, have been examined, and corrected with all imaginable care, the great circumspection employed to form an unexceptionable theory, or one which will serve to account for every chemical appearance, has not been hitherto attended with the success that might be wished, from the sagacity and application of modern chemists.

Its opponents, therefore, not reflecting that in the investigation of artificial substances, for the sole use of medicine, an exquisite degree of accuracy is unnecessary, will endeavour to avail themselves of confessed defects, and discharge their whole artillery at once upon a work which pretends to strike at the root of an offence, wherein every individual is so immediately concerned.

Besides, the charge of imposition exhibited in our new-coined term*, general as it is, and consequently neither pointed nor invidious, will nevertheless give offence and spirit up some, however unskilled in the operative part of the art, to quarrel with the manner, the matter,

* ΣΟΦΙΣΤΙΚΟΝ.

matter, and design, as fastidious, impertinent, and whimsical; whilst others, more conversant, be it supposed, with the management of chemical instruments, but misled by a mistake, which is too common, of confounding practical with speculative chemistry, or making this an inevitable consequence of the former, will be apt to think themselves sufficient masters of the subject to comment upon the present work, and attack it perhaps with a frankness peculiar to critical writers; insisting, by way of apology, for the severity of their strictures, that as the accusation amounts to no more than a rumour, industriously propagated to the disadvantage of the trading chemist, and artfully dressed up to alarm the apprehensions of simple prejudice, it deserves no quarter. But objections of this kind, the lot of every disinterested publication that clashes too much, in appearance, like the present, with the lucrative views of several vendors, as well as preparers of substances, capable of being reduced in price by an addition of bodies less expensive, are only to be answered by facts which cannot deceive. This however is not altogether the case in respect to a doubt, which has been raised to the general use of attraction, our fundamental assumption, in the rationale of chemistry.

The

The want of a settled principle of action, considered as the medium or means whereby numerous alterations of bodies are effected, whether they regard the preparing or examination of them, must necessarily involve an inquirer in perpetual difficulties; and leave him frequently undetermined as to the cause of some of the more intricate appearances. This obstacle therefore is to be surmounted, in a great measure at least, before we can venture to advance, with any hopes of success, into the experimental part of our specimen or introduction; or presume to discover how practitioners may be supplied with general instructions, deduced from physical truths, to proceed in the detection of pharmaceutical artifices or impositions after a regular manner.

Though corollaries and scholia are not to be denied their use, they are generally too indistinct or confined: and inferences, however fairly drawn from particular facts, where universality is requisite, do not seem happily adapted to supply præcognita for the more extensive purposes of this enquiry.

Without a knowledge of the constitution, or chemical structure, as it is sometimes stiled,

of

of substances, natural or factitious, which come under our notice, we must be egregiously to seek, in accounting for several changes and effects of particular substances upon each other; or shewing into what principle great part of the phænomena arising from the specific qualities of bodies in mixture, which chemistry lays claim to, may be ultimately resolved; nor less incapable of pursuing and developing the fraudulent practices of sophistication to any useful purposes: whereto must be added likewise an acquaintance with that established cause of action, just mentioned, which influences the several operations of bodies upon each other; from whence springs an infinite diversity and amazing alteration amongst concretes, from accidental causes in appearance, not less remarkable in the bowels of the earth than in the laboratories of the chemists.

Since, therefore, it is evident, from a diffusive survey of the productions of nature as well as art, that nothing but a competent understanding of these matters can enable us to fish out the cause of any chemical result with tolerable perspicuity, or throw out new lights, for the sake of conducting those whom defective processes, imperfectly recited, have hitherto

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misguided in a remarkable manner, while they were groping as it were in the dark, through the difficult and obscure paths of this abstruse science; and since the chief arguments which have been started, on account of the seeming impracticability of the thing, to an attempt that promises little less, when completed, than ample data for an useful, if not accurate, disquisition of some principal officinal productions of the chemical pharmacy, are to be answered upon these principles alone, and a probable method thence laid down for performing abuses which have been long practised, to the discredit and prejudice of this serviceable branch of medicine, the necessity of establishing a fundamental axiom or postulate, is indisputable, as well in chemical as philosophical enquiries, and its utility, in a disquisition intended to render the scientific part of chemistry intelligible to readers, who may not have made this part of medical knowledge a study, too obvious to be mistaken or rejected. In obedience then to the rules of good method, we are obliged premissively to shew its existence in a circumstantial and demonstrative manner.

Although a mutual tendency of those infinitely little particles of matter, whereon all chemical

chemical results, respecting compound bodies in particular, are unexceptionably founded, under proper restrictions not taken notice of by the mechanicians, has been admitted into the schools of philosophy for more than half a century; and the practicability of applying this property of the molecular of bodies to the *decomposition** or analysis of several compounded substances, or to the reunion of preparations of the opposite tribe, where it can be effected, with the bodies from whence they were or should have been dissevered, will be fully shewn in the subsequent pages: we must enter, nevertheless, into a formal proof of our position, lest it be urged, in spite of what has been already said, and not without some appearance of reason, by those especially who have not obtained their ideas of chemical alterations from the speculative part of the science, and are confined, on that account,

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* If it objected to the word *decomposition*, as applied here, conformable to the usage of other writers upon this subject, that it is not meant by the antient chemists, or even by Mr. Locke, to signify a division of the component particles of mixt or compound bodies, into their elementary or constituent parts, we shall only observe, without entering further into a verbal debate about an arbitrary term, that it seems applied, with equal propriety, to the analysis of compound substances, as to their more complex union; though it is in the last sense alone we meet with it in Mr. Samuel Johnson.

See his Dictionary under the word.

to the mere results of each process, that a work of this unlimited nature, erected upon the narrow base of experience, must naturally demand a greater length of time, and a more intimate knowledge of the steps of each operation, to render it of singular service in researches of this extensive nature, than most men of business, however capable, on account of their constant avocations, can find leisure to cultivate as they ought; and has therefore very little, if any, chance of answering many significant ends in the examination of factitious or fictitious bodies, to which this essay is immediately appropriated.

And if we take a view of pharmaceutical chemistry, agreeable to the present mode of practice, as the sole art of preparing a particular tribe of remedies, without even the bare probability of deducing any useful inferences or conclusions from them, in a scientific manner, in order to facilitate the investigation of numerous substances, unattempted by prior chemists, it seems a task of infinite labour; and asks an uncommon share of memory, and a larger stretch of genius than is usually met with amongst chemical operators, however expert, to execute with any tolerable exactness, through a tiresome catalogue

catalogue of articles, which, though they be separately examined, and with the utmost circumspection and practical understanding, will often disappoint our expectations; retard the progress of such enquiries; and weary the most assiduous in pursuits of the like sort.

Nor can it be otherwise, where neither the structure of bodies, natural or artificial, nor the reasons of these appearances and alterations which chemistry produces, in consequence of various commixtures, are in any wise understood. But to persons conversant in these necessary particulars, and capable likewise of observing the peculiar operations, or effects of bodies upon one another, so that the cause of these effects, where any change ensues, may be fairly assigned the arrangement of his subjects under such proper heads as may *contract that diffusive field of process, which mere experience presents, to an adequate compass with the limits of moderate attention**, though full of difficulty, becomes a much more easy and serviceable attainment; enabling us, with due care, to make one experiment lead to the investigation of a great number of bodies of the same order, whereby the bounds of medicinal chemistry has been

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much

* Institutes of Experimental Chemistry, Introduction, p. 3.

much more enlarged already than could have been effected from accounts in detail of each process, illustrated with the most precise observations; necessary, under such circumstances, to be treasured in the mind, or reduced to a kind of common-place, for occasional references.

And, in the confined state of chemistry just mentioned, this would be found indispensably requisite; and, of course, very hard to reduce into a system, in any tolerable space of time.

Thanks, however, to the diligence and abilities of some modern writers, many of these impediments are now happily removed. By a sedulous attention to the laws of nature, which former chemists were strangers to; and the discovery of a new species of attraction, some intelligent philosophers of our own day have shewn no inclination to admit; with a moderate addition of proper talents for making nice distinctions, the face of things has been surprisingly altered within these last fifty years. Whence, from an art of no inconsiderable form, it must be acknowledged, amongst different classes of people and professions, chemistry has by degrees advanced into a science of remarkable consequence to various

ous occupations, domestic and commercial, not touched upon before, as well as to metallurgy, medicine, and the politer arts. The improved state of divers branches of trade, remote from the view of our present essay, sufficiently evince the truth of this assertion; and the present known method of explaining, in a manner truly philosophical, a number of chemical phænomena, otherwise inexplicable, as satisfactorily as natural, gives it great strength. Neither is it less apparent in other parts of physical learning; which, to the lasting honour of rational chemistry and its cultivators, have received infinite improvements from this application of the fundamental postulate of the natural philosophers, including, without restriction, or generically, every species of attraction*; and therefore taken, in an unlimited sense of the term, to be the same absolute cause that regulates the universe.

It has been experimentally demonstrated, from the beginning almost of Sir *Isaac Newton's* philosophy, established upon the doctrine of
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* Ponenda sunt, fundamenti loco, hæc tria, quibus omnis physice innititur, principia. 1. Spatium inane. 2. Quantitatis in infinitum divisibilitas. 3. Materię vis attractrix.

central forces, whereby the planets are not only retained in their several orbits, but revolve in stated periods about one common centre, that the same *vis attractrix* or power, which directs the various movements of every part of our solar system, exerts its influence likewise, in a remarkable manner, upon the most minute particles of matter*, as hinted before, and will be further shewn hereafter; subservient, nevertheless, to particular laws, either neglected, or not understood, by those writers that originally adopted this universal postulate which now supplies the chemists, under due limitations, with fit principles for reasoning scientifically, or *a priori*, upon different branches of technical and medicinal chemistry; and of instituting feasible experiments for disuniting the component parts of several factitious bodies, or otherwise examining suspected preparations, or untried medical substances to advantage. For though they frequently carry such evident marks of artifice or imposition about them as render trials unnecessary, they are, nevertheless, sometimes so dextrously managed as not to be discoverable, except by means of the chemist's art;

* Præter vim illam attractricem, qua planetarum cometarumq; corpora in propriis orbitis retinentur, illa etiam inest materie potentia, qua singule ex quibus illa constat particule se invicem attrahunt, et reciproce a se invicem attrahuntur. *Id. ibid.*

art; which, judiciously exerted, very rarely fails of detecting the most material frauds.

Hence, then, it is humbly presumed, the most striking objection to an enterprize of this kind, however extravagant or improbable it may appear at first sight, will gradually decline with the more discerning part of our readers; and not only the validity of the argument, respecting medicinal enquiries, be allowed, but the singular uses of spagiry in physics sufficiently proved. For, notwithstanding the suggestions of some gentlemen, totally unversed, as it seems, in chemical results, it is obvious from the premisses, that experimental philosophy may be assisted, from the sources of chemistry, with proper hints for carrying its enquiries into the operations of nature, amongst the most minute or elementary particles of matter, infinitely further than the liveliest imaginations of its admirers could ever figure to themselves without it: since a multitude of natural appearances, not to be resolved upon the confessed laws of physical attraction, as stated in books of experimental philosophy, may be accounted for in a pleasing and plausible, if not always in a satisfactory or demonstrative manner, upon the settled principles of chemistry; inasmuch
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that it is not easily decided which of the two sciences, says a late author, is likely to reap most benefit in the end from what may be stiled, without impropriety, the universal affection of matter.

*It is evident, says the ingenious Hoffman *, to every smatterer in science, that the present method of investigating the virtues, effects, and properties of bodies, from their texture, specific qualities, and formation; or, in the strict language of physics, from the mechanism of their constituent parts, is truly rational and unexceptionable. But in the whole circle of arts, continues our author, if we except Chemistry, there is not any whereby we can so readily obtain an insight into the theory of dissolution, or decomposition of mixts; or discover how the structure and native properties of bodies may be altered and diversified a thousand ways. From which considerations, added to many others, it*

* Genuinos philosophiæ naturalis professores nostrâ ætate, corporum vires operationes atque potentias, a solâ partium variarum quibus constant texturâ, naturâ atque structurâ, sive ut appositè loquuntur, mechanismo rectissimè derivare, ecquis nisi plane rudis sit, ignorat. Jam verò in universo disciplinarum ambitu, præter chymiam nulla est quæ tam facile ostendat artificium quo corpora mixta dissolvi, eorumque texturâ transformari, et proprietates insitæ in alias atque alias mutari et detorqueri possint. Dictu incredibile est quantum in potestate habeat chymicus, et quam mirabilia ipsi præstare liceat.

Hoffmanni Observ. Chym. Præfat. Epist.

it would swell this essay too much to recite, he concludes with telling us, that the *powers of Chemistry*, in proper hands, are truly incredible. The celebrated *Vogel** too, remarks to the same purpose, that, *since it is apparent, from the connection of different compounds; from the resolution or analysis of compounded bodies into their elementary parts; from the connecting of simple substances with other simples, or with compounded bodies; that an infinite variety of new concretes*

* Quapropter ex commissione compositorum cum compositis, ex separatione compositorum in sua simpliciâ, ex commissione simplicium cum simplicibus, et simplicium cum compositis, infinita oriri posse nova corpora, et innumerabiles incognitosque prius effectus facile est ad perspiciendum: Igitur chemiam primò dextram manum physicæ salutamus. Hæc enim, dum cognoscendis universalibus corporum attributis saltem occupata est, et eas tantum apparitiones, quæ sensibus manifestæ sunt, colligit, non adeò multum sane utilitatis nobis affert, nec perfectæ corporum cognitioni comparandæ par est. Dum vero alia his corpora applicantur, dumq; de industria instituuntur experimenta, eoque proposito, ut pateat, quid in his natura molitur; tum demum illi corporum effectus, qui ex singulari ipsorum indole pendent, nobis patefiunt; sicque accurata demum rerum habetur cognitio. Atque his quidem sola chemia excolendis apta nata est. Neque vero hic pedem figit, sed altius multo progreditur, et ipsa rerum phænomena imitari docet. Unde fit, ut secretissimas naturæ vias non modo nobis detegat, sed tutissimum quoque ad ipsas causas phænomenorum eruendas fontem apperit. Neque sane prius otiosæ speculationes ex physicis deletæ sunt, quam recte exculta mortalibus chemia fuerit. *Vogel Instit. Chem. p. 19.*

concretes may be produced, and a number of properties and effects, which were unknown before, discovered, Chemistry is to be looked upon as the chief spring, or master-key, as it were, of physical understanding. For whilst philosophy, adds our author, busied in tracing the universal properties of matter, is satisfied with collecting only such phenomena as are the object of our senses, it is doing no material service. Neither is this superficial manner of enquiring into things calculated in the least to give us a thorough knowledge of the nature of particular bodies. But when some other concretes are applied to them, and rational experiments attempted, with the sole intention of investigating the orderly procedure of nature in her different operations upon them, these effects of particular substances, which depend upon some singular properties, peculiar to themselves, are laid open; and thus at last we obtain a more comprehensive idea of the powers, faculties, and distinct qualities of things. And, for pursuits of this kind, it is only Chemistry that is properly adapted. Neither is it cramped within these narrow limits, or content with tracing the wisdom of providence in the works of the creation; but mounts into a much more elevated sphere, and instructs us how to imitate these very phenomena. Whence it follows that Chemistry does not present us with a view of the more retired
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walks of nature alone, but likewise discovers the source from whence the cause of many physical appearances may be most securely drawn. Neither, concludes the same author, to shew its further use in natural philosophy, were idle speculations banished the schools where that science was studied, before men began to cultivate the art of Chemistry upon right principles.

To these may be annexed the sentiments of an intelligent Swede*, who held it impossible, long since, to make any progress in the science of physics, without chemical knowledge; which he assigns as a reason for its being cultivated, in his time, with more industry than it had been before. Dr. Boerhaave observes too in one of his orations, that the great Newton†, whom he justly compliments with the highest degree of human pene-

* Quum autem in naturæ scientia, sine chymia nullus progressus obtineri, nil certi aut manifesti sperare queat, &c.

Urban. Hierne parasceve. pref. p. 7.

† Ille, licet adeo felix ut cum vivente de principatu in philosophia contendat nemo sanus, quando leges, actiones, vires corporum ex perpenis demonstrat effectis, non aliud quam chymiam allegat; quando inventas ibi vires iterum extricandis applicat phenomenis, mera chemica advocat, claroque testatur exemplo, abfuisse chemia, singularium corporum propriam indolem, proprias vires, vix potuisse mortalium perspecacissimo cognosci. *Dissertatio de Chemia suos errores expurg.* p. 39.

penetration: though a philosopher so confessedly superior to the rest of mankind, as not to meet a competitor for the palm, whilst living, when he demonstrated the various powers and actions of bodies, from a consideration of their effects, his proofs and illustrations were all deduced from chemical results; and when these discoveries were again applied to the explanation of their own or other appearances, the aids of Chemistry alone were summoned for that end. From whence, says our author, we have a shining example, that it would be impossible, without Chemistry, for a person of the utmost sagacity to become acquainted with the peculiar qualities, or specific properties of bodies.

And yet the ingenious Dr. Friend, who was strongly attached to the corpuscularian philosophy, and unwearied in his endeavours to establish a rational Chemistry upon the allowed fundamental of physics, did not meet the success he hoped, from an attempt to explain solution, in its most obvious sense, upon the illustrious Newton's principles; owing, perhaps, to a false, or a too indiscriminate idea of the nature of that species of attraction, which exerts its influence on the elementary parts of mixt and compounded substances, and is now considered as the medium of nume-

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rous chemical changes; though, for want of suitable experiments and observations, it was then imagined, even by this great master of science, to be one of the four kinds, recited in books of natural philosophy, and applied as such to the solution of chemical and natural appearances, as the numerous queries inserted at the end of the latin edition of his own Optics * fully evince.

Misled by this supposition, our author † undertook to apply that *vis attractrix*, which the mechanicians had adopted for philosophical uses, to the explanation of chemical truths, ‡ as we learn from a course of lectures on the principles and operations of Chemistry, read at

* Page. 322. † Dr. Friend,

‡ Illam attractionis vim quam in grandiore corporum coelestium mole primus et acuté perspexeras et feliciter explicaras, multi ad illustranda naturæ phænomena transfulerunt: hanc vero, quam etiam in minutissimis corpusculis vigere et * olim non obscure innuisti, et † nuper multiplici experimentorum varietate comprobasti, vix nunc tandem advertere atque excolere incipimus. Principium hoc cum nemini adhuc visum sit ad rem chymicam accommodare, ego, quid hic etiam valere possit volui pro meis viribus experiri: hujusce tui rationcii eam esse vim intelligo, ut si quis id recte adhibere noverit, quicquid in theoria chymica difficile et perplexum sit, simplicissime expediat.

Friend. Praelect. Chem. Dedicat.

* Præfat. princ. natur. philos.

† Optic. latin. edit. aut. *Is. Newton*, Equit. Aurat.

at Oxford in the year 1704; ill translated afterwards, and prefixed to the old editions of *Quincy's English Dispensatory*, under the appellation of a theory of Chemistry. The Doctor, in an appendix to his own edition of this work, published by way of reply to the invidious reprehensions of some *German* writers, who had charged him with sheltering consummate ignorance under a sounding term, very fully refuted their wild figment of magnetic spheres of subtle matter, and supported himself sufficiently against their objections, and other irrational conceits of foreign schools.

But indeed these hasty reflections of his heated adversaries, void of proofs as they were, seemed to arise in part from inattention to the subject, on account of its novelty; and partly from a warm prejudice in favour of their countryman *Leibnitz*, and his followers, who could not be persuaded for some time to entertain a favourable opinion of the *Newtonian* doctrine of attraction and repulsion, for reasons not necessary to urge in this place.

Since, however, the theory of Chemistry, it is universally admitted, can be only established upon this evident, and not imaginary property,

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as its opponents would have it, of matter, it must therefore be considered as the only firm basis of rational Chemistry; especially as it supplies us with proper principles and postulates, from whence a tolerable idea of some surprising changes, different substances are observed to undergo, by a judicious application of suitable bodies, may be obtained; and a reason assigned for their several disjunctions or combinations, agreeable to stated laws, which have been observed to exert their influence, though not mechanically, as it was at first mistakenly supposed, not less in the most minute parts of aggregates, mixts, and compounds, natural or artificial, than in the largest masses of matter.

And since this truth appears to be of the first consequence in discovering the reason of chemical phenomena in particular, founded altogether upon a competent knowledge of the peculiar effects of an attractive power; whence we are enabled to lay down easy rules for examining factitious or fictitious substances, and to investigate several artifices passed upon the less skilful part of the profession, with surprising readiness and accuracy, great honour is deservedly due to the memories of the celebrated

brated Dr. *Kiel*, and our ingenious countryman Dr. *Friend*. *

It was these gentlemen who first obliged the world with an attempt to extend the fundamental postulate of mechanical philosophy, though erroneously in some measure, as will appear in the subsequent pages, to a solution of chemical alterations, from hints dropt by Sir *Isaac Newton*, in the preface to his *Principia*, and afterwards enlarged upon by an ample enumeration of chemical results in *Clarke's* translation of his *Optics*, as before observed; from whence alone the rationale of numerous process of Chemistry, and a detection of several medicinal frauds can be fairly deduced.

Notwithstanding the objections of the *Leipfic* editors †, and a few authors besides, who have attacked the Chemists upon this head, it is evident at present, from repeated experiments, some of which we shall have occasion to mention, when the preceding doctrine is applied,

* *Præsenti sæculo multam lucem chemiæ physici attulerunt J. Friend, in prælectionibus chemiæ, Oxon. 1704. Fred. Hoffmann in observat. physico-chymicis, Hal. 1712, &c. &c. &c. Vog. Institut. Chem. p. 24. sect. 56.*

† Page 78.

that this species of chemical knowledge can be only attained in proportion to our acquaintance with the various particularities of a reciprocal tendency, observed to exist in the ultimate or constituent particles of bodies. And though, from a too superficial enquiry into the peculiarities prevailing in that universal affection of matter, as it has been styled, which was employed to solve a number of the phenomena of Chemistry, many opportunities were given to gentlemen of sagacity, while our science was in its infant state, to remark with great reason upon the insufficiency of a favourite notion, however just in general, when extended, as there is no doubt it frequently was, beyond the warranty of experience; which neither authorized its use, as a mechanical instrument of chemical results, nor seemed, from a vast variety of appearances, where it has manifestly no place, to promise much emolument to the speculative part of the art.

Attraction, however, under stated circumstances to be recited hereafter, triumphed at length, like several other useful discoveries, that have met a similar fate, over all opposition, and very soon became, in the words of

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the Psalmist, *the head stone in the corner**, being now held, amongst those who admit of axioms in science, as the *sine quâ non* of sound chemical reasoning; from whence we are enabled, as in physics, to make just conclusions, and often to predict the event of new processes in different classes of bodies; and even to trace the cause of effects, unnoted before, with unexpected readiness: so that not only the rationale of pharmaceutical and other chemical operations is deducible, in a multitude of instances, without much if any perplexity, from this postulatum alone, under due restrictions; but new experiments proposed, with great probability of success, to say no more, upon the same *Lemma*, for investigating suspected substances, and advancing the present imperfect state of pharmacy with an useful addition of medicines to the catalogue of our own colleges, as may be easily seen in the different instances of *Magnesia Alba*, and the approved salt of *Rockelle* before us: for neither of these substances have yet obtained a place in the *London Pharmacopœia*; whilst it teaches us to improve upon the present methods of preparing some *Galenical* compositions, where, as taken notice of before†, the necessity of a previous acquaintance with the peculiar

* Psalm cxviii. 22.

† Page 52.

peculiar qualities of each ingredient, or the nature of their constituent parts, in order to preserve them uninjured, can admit of no dispute.

From the impossibility, nevertheless, of applying this principle, under any of the four species of physical attraction, to the explanation of chemical alterations, synthetical or analytical, there is reason to apprehend it would not, even yet, have been allowed of as the fundamental postulate of speculative Chemistry, had not the celebrated *Geoffroy*, and a few other writers (to whom, if I am not greatly deceived, we are chiefly indebted for our first idea of subordinate attractions, or comparative affinities) examined the rudiments of *Keil* and *Friend* with a rigorous accuracy; expunged their errors with candour; and illustrated or confirmed their general notions of the universal affection of matter, abstractedly considered, by such a series of examples, totally unimagined before, as left no room for doubting the mutual and orderly tendency of particular bodies, or the parts whereof they consist, towards each other; signified in general by the technical term *attraction*, and ocularly demonstrated to exist in the smallest molecule of which all aggregates consist; as well as in the ele-

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ments of mixts or compounds: nor of its being invested with powers very different from any of the several kinds enumerated by the mechanician; and most properly denominated chemical, because it appertains immediately to the results of that class.

Hence then arises a fifth order of attraction, as necessary, in solving some natural phænomena, as any of those already adopted by the philosopher; though neither subject, as frequently premised, to the settled laws of gravitation or cohesion, nor endowed with the characteristic properties of magnetism or electricity, it will be shewn in the subsequent pages; but furnished with peculiarly circumscribed faculties which incline particular bodies, whether simples, mixts, or compounds, natural or factitious, to connect themselves with one substance sooner than with another, whereby we obtain the idea of what some late Chemists have been pleased to signify by the term *elective* or *specific attraction*; while with some bodies they retain, permit me to say, since it involves no absurdity, a sort of aversion to unite in any degree: "whence such bodies have been said to be neutral, in this sense, to one another." *

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* Institutes of Experimental Chemistry, Vol. I. p. 9.

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Numberless instances of the same kind might be produced, both in the composition and decomposition, named, by the writer just quoted, the departure of bodies; and accounted for in consequence of the addition of a third body, to any suitable mixt or compounded substance; which third body, from its tendency to unite with one of the constituent parts of the compounded substance rather than with the other, or, in other words, from a superior attraction between one of the component parts of the mixt and superadded body, with some other conditions to be noted hereafter, a new union succeeds; and, of course, a different concrete is produced.

But the present essay is only intended to lay the foundation of another work of more extent, by attempting to place the peculiar nature and uses of that attractive power, represented by different authors upon the subject of Chemistry, under the various appellations of affinities, relations, or attractions elective or specific, meaning the same thing, in a light more suitable to the capacities of younger students; or better adapted to the unaffected manner of our own philosophy, which delights in a comprehensive simplicity, than there is any

prospect of accomplishing by subtile distinctions or unnecessary subdivisions; whereby our faint ideas of natural things are more likely to be confounded than enlightened; and to apply it also, by way of illustrating this doctrine of the Chemists, to the examination of several officinal productions. It will therefore be sufficient to observe, that many compound bodies, especially saline, may be constituted and destroyed at pleasure; and their component parts rendered capable of being made the objects of our senses, by the means already premised, as in sal catharticus amarus, nitre, sea-salt, sal de saignette, &c.

That the surreptitious *Epsom-salt* of the shops, from the bittern of the salt-pans, called by some *Magnesia Glauber's Salt*, for instance, is liable to be broken to pieces, and reunited at pleasure, by the alternate affusion of an alkaline and proper acid liquor, is no longer a secret to the experienced spagyrist. In order to accomplish this end, however, it is to be remembered that one of these substances at least must be in a fluid state, or a state of solution, for reasons to be urged hereafter.

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Now these singular changes, they may be stiled without any impropriety, whereby the constituent parts of mixts, or more complicated substances, are thus disunited, or separated from each other, are the apparent effects of an attractive power, previously known to the speculative Chemist, though no reason can be assigned, as in the *Newtonian* philosophy, for the cause of these effects; whereat some gentlemen, of very respectable characters in the republic of letters, have taken umbrage; discovering a strong objection to the allowance of any attraction, undreamt of in their system of physics, into natural knowledge, or even into Chemistry; and have carried their opposition so far, where the facts in favour of attraction, applied to chemical results, are too striking to be wholly resisted, as to doubt, says the author, of the institutes of experimental Chemistry, "whether the whole of the appearances which suggest them may not be resolved into one general attraction of cohesion, modified, so as to produce these different effects, only by the configuration of parts, or other accidental situations or circumstances, into which the bodies that become of one species are brought by some common cause.*" Tho' the

* Introduction, p. 7.

the necessity and existence of another kind of attraction, besides those which are to be met with in books of natural philosophy, is evinced by experiments that speak decisively to the eye, and irrefragably prove the absurdity of a contrary supposition.

The method of resolving many chemical effects into one of the four confessed species of attraction prevailed for some time, it must be confessed, after that extraordinary revolution which the state of physics experienced, to the immortal honour of its author, from the notional vortices and plenum of *Des Cartes*, to the central forces and vacuum of *Sir Isaac*: But this was fully refuted at length, and its authors censured, not impertinently, for attempting impossibilities in the way of science upon a wrong principle. Experiments, however, inadequate to the purpose, or an over transient manner of observing the reciprocal effects of the constituent particles of some bodies upon others, in a multitude of chemical results; or the common error of applying particular phenomena to general purposes, before they had been established by a proper number of facts, may be assigned as the most probable, if not the sole causes of these mistaken conclusions;
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seeing a much juster way of reasoning has been since deduced from attentively considering some of the same, or other not less satisfactory results of chemistry: whence several particularities, of infinite use to the rationale of the art, have been discovered, respecting the laws and peculiar effects of the general *vix attractrix*, which we shall have occasion to take notice of, and employ very commonly hereafter, in speaking of the numerous alterations induced upon various bodies by the processes of the Chemists.

This appears from the subsequent attempt of our own countryman, the celebrated Dr. *Friend*, in his *Prælect. Chymicæ**, where he endeavours to account for chemical solution from the mere comminution of the † integrant particles of the

* Page 88, &c.

† It is too frequent, in books of philosophy, to find the ultimate particles of compound bodies called, improperly, their constituent parts. Though it is obvious, without recourse to facts, that, by constituent parts, must be understood the distinct parts of which any substance is composed; as in antimony, the sulphur and regulus; in sulphur, the acid and phlogiston, or inflammable principle, &c. but where bodies are divided, however minutely, without injuring the internal texture, as iron, tin, wood, glass, &c. by the file, saw, hammer, or any other mechanical means, the parts thus separated from each other are integrant, and not constituent parts; otherwise composition could not be allowed to take place amongst natural substances,

the solvend, and a slight degree of tenacity in the menstruum or solvent.

When, says he, to make use of his own argument, metallic substances are regularly suspended in acid menstrua, and form with them a fluid seemingly homogeneous, it is because the metals, losing their absolute weights by division much faster, as the mathematicians demonstrate, than their magnitudes, become very nearly of the same specific gravity with the solvent liquor, (which does not follow) and are, for that reason principally, supported by it.

Indeed the preparation of silver, called *Greek-water*; the solutions of mercury, iron, tin, copper, and other bodies, equally soluble in acids, as well as different menstrua besides, would give some countenance to such an opinion, if the fallacy of this doctrine was not refuted beyond the possibility of a question by the celebrated *Stahl's* experiment*; which, for the sake of such as have not had an opportunity to revise any of his works, or to prosecute these enquiries with suitable attention, shall be recited

* Philosophical Principles of Universal Chemistry, by Dr. *Shaw*, page 40.

recited at length; without mentioning other facts, demonstratively proving that metalline or less solid bodies, in a state of dissolution, may be regularly separated, or discharged at discretion from their solvents or suspending liquors, by the addition of a particular substance, previously known to unite more readily with the fluid employed; while the solid already dissolved, and thus instantly superseded, if specifically heavier than the new compound liquor, generally subsides, in its original form, to the bottom of the vessel; but not always, as will be observed more fully hereafter.

A phenomenon not to be explained, it is obvious, upon the principles of the mechanicians, from an infinite number of chemical changes of the same kind, we must not stop to enumerate; but readily accounted for in a multitude of instances, by the superior tendency of one of the constituent particles of particular compounded bodies towards the superadded body; whereon the usual methods of combining and separating various classes of natural concretes to advantage principally depend: from whence a number of new substances have been discovered, and the art rendered of singular service to mankind: the Chemist being enabled,
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by these means, to examine into, and very frequently to detect pharmaceutical frauds, with the utmost certainty, in many capital remedies of the shops, which there would be no possibility of having well ascertained by probable conjectures or indefinite conclusions; for they seldom give the satisfaction of rational deductions from fair experiments.

“Gold, copper, and iron also in part, says our author†, “are dissolved in aqua regia; “but all the metals, except gold, by aqua fortis “and spirit of nitre, though one more readily “than another. Suppose silver therefore dissolved in good aqua fortis or spirit of nitre, “and the clear solution decanted. If plates of “copper be put into this solution, the menstruum will dissolve them, and let fall the silver, “it had before dissolved, in the form of a white “powder. When the menstruum will dissolve “no more copper, let the clear solution be “decanted from the silver powder at the bottom, and poured upon iron filings, and it “will attack these with a considerable noise, “dissolve them, and let fall the copper it before contained. This solution of iron being “filtered and poured upon zinc, the menstruum “will

* See page 90 in the notes.

“ will dissolve that, and let fall the iron.* Let
 “ this clear solution of zinc be separated from
 “ the iron, and poured upon crabs eyes or oister
 “ shells, and the menstruum will now dissolve
 “ these, and let go the zinc. If this solution be
 “ filtered, and spirit of urine or spirit of sal-
 “ ammoniac be poured thereto, the menstruum
 “ will imbibe this, and let go the testaceous
 “ body. Lastly, to this clear liquor add the
 “ liquor of fixed alkali, and the urinous salt
 “ will be separated, though it does not fall to
 “ the bottom, but, according to its own nature,
 “ rises to the top,” or escapes, in part at least,
 into the open air, as may be discerned by the
 volatile pungency of the separated urinous salt.

Hence it seems by the way as if some apter
 mode of expression was wanted to give us an
 adequate idea of the several results, comprised
 within this class of preparations, than the am-
 biguous term precipitation, usually employed

† Notwithstanding the copper and iron, in this experiment,
 are said to be precipitated in their metalline form: it is not to
 be therefore concluded, that these metals were thus suspended
 in the menstruum or acid liquor: For had the precipitation
 been effected by means of a fixed alkali, instead of another metal,
 the event would have been otherwise, and only a metalline calx
 deposited instead of a true metal.

See *Lewis's Materia Medica*, preface, p. 22.

to signify every kind of separation*; and sometimes even the inspissation of a body dissolved in acid or other fluid menstrua. For although the solids disunited from their solvents, by an addition of proper substances, gradually settle to the bottom, when more ponderous, bulk for bulk, than the new compound liquor; and thus give us the natural idea of precipitation: This event is merely casual, and unsatisfactory to the novitiate, as may be shewn in a variety of instances, where some bodies are observed to emerge or float upon the surface, whilst others, not separated at all from their menstrua, are nevertheless denominated precipitates. Should we not, therefore, studiously avoid, as much as possible, the use of equivocal expressions in a scientific art, where appearances, frequently contradicting the obvious sense of a technical term, will be very apt to mislead the less conversant in these matters? Unpractised in the phraseology of the profession, an indiscriminate use of words, which are intended to carry very opposite meanings, as in the present case, must necessarily create confusion in our ideas of the same operation, naturally supposed to

* *Solutæ rei cujuscunque separatio, a menstruo et secessio, sive deorsum fiat, sive sursum, præcipitatio vocatur.*

Vogel. Institut. Chem. p. 368.

to exhibit the same phænomena at all times. Would it not then be very serviceable in this extensive part of chemistry to correct the present indeterminate way of speaking? And would not the young inquirer be singularly benefited by a careful and proper division of the comprehensive term separation into its several parts, noting, or, more strictly, marking some of its obvious effects on each particular process, where dissolved substances come under our inspection, either to be inspissated, precipitated, or otherwise disunited, wholly or in part, from their several solvents? And has not our own college, truly sensible of the necessity of correcting such a gross misapplication of terms, made some useful advances of this sort in their variations of the names of a few officinal preparations, as *mercurius corrosivus ruber*, and *mercurius calcinatus*, called very improperly, by all our old Dispensatory writers and Chemists who have treated of pharmaceutical operations, red precipitate, and precipitate per se: where it is to be remarked, by the way, that precipitation has not any share in either of the preparations, one being the mere effect of a well-regulated and continued heat, and the other made by abstracting part of the moisture from the mercurial solution, and afterwards forcing off
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most of the remaining acid with a strong fire; whence, by degrees, the mercurial mass loses its white colour, and becomes at last very red. But to return to our subject.

Upon duly considering the preceding series of changes recited in this experiment of Dr. *Stahl*, the existence of different orders of attraction, as well as that general tendency of the particles of different solids described above, to unite with the same acid, is fully evinced; neither is this subordination less obvious, in the acids themselves, than in various solids exposed to the same acids. The vitriolic acid Dr. *Newmann*† observes is more powerful than any of the rest, and expels them all from the alkaline salts, fixed or volatile, and from the soluble earths. This holds true likewise of the nitrous and marine acids; the former constantly dislodging the latter: whence it follows, that their property of uniting with saline and earthy substances has its degrees, and supplies us with a reason for *Glauber's* use of the strong acid of vitriol in making his smoking spirit of nitre, in order to facilitate a process that would otherwise

† Page 92, 93.

† Chemical Works by Dr. *Lemay*, 4to, p. 162, and in the notes.

wise have required the continuance of an intense heat for some time.

The acid of sea-salt, a preparation well known to every common operator, may be obtained by a similar application of the nitrous acid; and this recovered again, as already hinted, by an addition of the vitriolic. *

And altho' the cause of these effects cannot be assigned upon the principles of the mechanicians, it is clear, nevertheless, to a demonstration, through the surprising alterations observable in the preceding experiment, from *greek-water* to the formation of *cubic nitre*†, that there is an attractive virtue, inherent in the elementary parts of bodies, which inclines some of them to unite with others; and which must be considered as the medium or agent of chemical results, as will be shewn by and by; but invested, however, with properties distinct from any yet admitted into the settled doctrine of physics, where the effects of sensible bodies and their integrant parts alone are treated of; and is not therefore reducible to any of the four kinds

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* Acidum salis debilius et specificè levius est acido vitriolico et nitroso, hincque per utrumque ab alcali suo liberandum.

Vogel. Instit. Chem. p. 206.

† Page 92, 93.

of attraction, taken notice of by experimental philosophers. This, therefore, for reasons to be enforced hereafter, we shall venture, with some intelligent Chemists of our own time, to distinguish from the rest, by the particular appellation of *chemical attraction*, rather than any other name; as it partakes of faculties unobserved in any species of attraction besides, which has been hitherto introduced into philosophy.

We shall endeavour likewise to prove the existence of this power in the minutest particles of natural and artificial compounds, subservient to the purposes of Chemistry, by a train of proofs, drawn from the practical part of the science; whereby the prejudices some gentlemen have imbibed to this new way of reasoning of the Chemists may be fairly refuted, and a rational account attempted of the numerous changes induced by means of the addition of different substances, to the same menstruum successively, endowed with powers peculiar to this new species of attraction; which, notwithstanding its existence be no less demonstrable than the confessed attraction of the earth, the rubbed tube, or the ultimate particles of solid or fluid substances amongst themselves, a late writer, unacquainted, as it seems, with the

less obvious parts of natural knowledge, has treated this opinion, from the singularity of its laws, as a mere figment.

After censuring the Chemists very frankly, in his observations upon their unsatisfactory method of explaining solution by attraction, for their unphilosophical relation of that phenomenon, this author has carried his objections so far as to charge them expressly with "introducing so many different sorts of attraction into nature, as to make their explication of things by attraction little better than the *Aristotelian* explication of them by occult qualities." Thus strongly opposing the admission of any other kind of attraction, than what the experimental philosophers have allowed of since the great discoveries of Sir *Isaac Newton*. But from what follows in the subsequent part of this essay, it is presumed the contrary will be rendered indisputable, and an attraction invested with singular properties, appertaining to chemical appearances chiefly, as sufficiently proved as any of the four kinds adopted by the mechanicians.

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* Dr. *Rutherford's* System of Natural Philosophy, 4to, Vol. I. p. 9.

That a mutual tendency to coalesce or unite with each other is discoverable amongst the particles of simple, mixt, or compound substances, without specifying the kind or peculiar nature of this coalition, will scarcely be questioned by those who have attended the crystallization of salts. These, it is known, require a determinate quantity of liquid, in order to preserve their proper figures in shooting. If reduced too near by evaporation, as it sometimes happens, the particular forms, whereby they may be certainly distinguished in many cases, will not only be injured, but destroyed; whilst, on the other hand, if suspended in too large a proportion of the fluid solvent, no crystallization ensues, as the practical chemist very often experiences to his cost.

This, therefore, whilst it apparently shews a necessity to promote the approximation of these infinitely little particles of saline bodies suspended in their proper menstraums, for the sake of their concreting into regular forms, which depend, according to the philosophers, upon a repellent force, that they may be enabled to act properly upon one another, shews us likewise that this operation may be carried beyond its proper limits, which are influenced
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by different considerations; so that the requisite distances are not always alike*. Hence arises a proof of the occasion there is to allow room in the saline fluid for this end, which may be so much over-charged, it appears, that the crystals shall not be able to preserve their specific forms in shooting unimpaired, agreeable to the peculiar nature of the saline molecularæ which attract each other at different distances, in proportion to their respective spheres of activity: for if too much water be evaporated before they are set to crystallize, the salts, it is known, will be formed in a powdery substance.

In the combination of acids, and absorbent or metallic earths; whence allums, vitriols of different kinds, the common purging salts of the shops, as *Epsom* and its substitute, *Scar-*
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brough,

* That the parts of salts attract one another, appears from uniting into hard lumps when the water is evaporated; so that the particles come so near to each other, as to be within the power of attraction. That they *repel* one another at farther distances, appears from the regular figures into which they coalesce; when, by the evaporation of part of the fluid in which they float, they are brought within each other's spheres of attraction; these regular figures depending intirely upon the equality of their distances one from another before this evaporation; and this equality of distance being owing to an equality of repelling force. *Dr. Desaguliers's Course of Experimental Philosophy*, 4to, Vol. I. p. 17.

brough, Lymington, and most of that tribe, usually made from the bittern of the salt-pans, we are furnished with sufficient instances to corroborate the truth of our assertion. Neither is the validity of what has been premised less evident in the present practice of analysing bodies, or destroying their natural connection, by a disunion of their constituent parts, whence new substances may be procured for medicinal purposes: mitigating their noxious acidity by simple addition and abstraction, or uniting them with other bodies, in such a manner as to give them new forms. To instance in the three mineral salts, *viz.* the muriatic, nitrous, and vitriolic. The acid part of these several salts, it is known, have their noxious activity abated by an admixture of water, or spirit of wine, and gentle distillation, whence spirits of vitriol, simple aqua fortis, and the dulcified spirits of salt, nitre, and vitriol. And these acids are likewise sometimes united with solid substances for pharmaceutical uses, as in tartarum vitriolatum, *Glauber's salt*, arcanum duplicatum, or sal enixum *Paracelsi*, sal secretum *Glauberi*, sal martis, &c.

The same observations offer in the practice of reconnecting some distinct parts of neutral bodies,

bodies, whereby they are made to resume their original forms, as in *Magnesia Alba*, the nitrum fixatum of Boyle, &c. These earthy and saline substances rejoined with the acid of vitriol or nitre, from which they were before intentionally divided, recover their natural textures, and give another undeniable proof, as in the sal catharticus amarus and common nitre of the shops, made by a reunion of their component parts, that there is a *vis attractrix* inherent in the elementary particles of matter, from whence a number of chemical effects may be fairly deduced. In short, examples of the like kind are endless; all art and nature equally declare in favour of this general assumption.

Look through the various orders of chemical processes, where the most convincing evidence appears of the existence of this property, and of its residence in the ultimate and constituent molecule of aggregates, mixts, and compounds. Are not the effects of this power apparent in the crystallization of salts, and in the confessed union of earthy and metallic substances, with their solvent acids? Does not the proportionable diminution of *Magnesia Alba* in all its dimensions, as it dries, very clearly demonstrate the existence of this power? And is not the proof
of

of its acting more powerfully than gravity apparent, beyond the philosopher's reason, in the force required to separate the constituent parts of neutral substances? Does not the property of that attractive virtue which exerts its influence upon some parts of mixt or compound bodies, as we have shewn already, whilst it leaves the rest untouched, produce a striking instance of its peculiarity and use, at the same time, in tracing the component parts of such mixts or compounds; and consequently of detecting fallacies in the composition of numerous preparations, subject to this kind of experimental enquiry?

The consti-^{tu}ence of *native cinnabar, sulphur, antimony*, and even of the *imperfect metals*, liable to be destroyed and recovered again, to pursue the subject no further, are strong confirmations of the same fact; and the difficulty of separating the fuming, elastic vapours of nitre or sea-salt from their alkaline bases, without a stronger acid, is an irrefragable argument of the compactness of their union. From whence it seems that this inclination of the ultimate particles of matter to coalesce, invested with some peculiarities, overlooked by the first authors upon the subject of philosophical Chemistry, which
we

we shall speak of more fully hereafter, may be fairly assumed as the fundamental postulate of an useful chemical theory; and applicable, in a more particular manner, from what has been just premised, to the immediate design of the present essay.

Since there will be occasion, however, for the constant use of this *vis attractrix*, in applying what has been already advanced. And as the annexed specimen, intended to illustrate or further confirm the truth of a doctrine whereon the detection of abuses, as well as the rationale of chemical processes totally depend, and are only to be dispatched, there will be no probability of making any considerable progress in the material part of our work, without previously examining into the difference observable between the particular attraction of the chemists, and that of the natural philosophers.

In order therefore to specify some of the distinct properties of a power so generally serviceable to the speculative part of our art, as well as to physics*, though not so universally admitted

* See Dr. Hamilton's Dissertation on the nature of evaporation and several phenomena of the air, water, and boiling liquors. *Phil. Transact.* Vol. LV. p. 146, &c.

admitted into the former, it will be necessary to shew wherein it varies, or is distinguishable from every one of the other kinds, but principally from the attraction of cohesion whereto it is supposed to be most nearly allied. Whence the illustrious *Newton*, as repeatedly observed before *, was tempted to believe that the various appearances of Chemistry were to be most naturally accounted for upon the fourth species of attraction adopted by the mechanicians. For, after reciting a vast variety of chemical changes, and frequently insinuating the influence of the attraction of cohesion, he concludes with supposing it † “possible that the minutest particles of matter,” which he looks upon as perfectly hard and impenetrable, “may cohere by the most powerful attractions, and thereby constitute the first order of bodies; and that these particles uniting again, but less firmly, may produce larger moleculeæ, and

* See page 59, 77, 80.

† Jam quidem fieri potest, ut materiæ particule exiguissimæ, attractionibus fortissimis inter se cohæreant, constituentq; particulas majusculas, quarum vis illa attrahens debilior sit, harumq; particularum majuscularum permultæ, inter se itidem cohærentes, particulas majores constituent, quarum vis attrahens adhuc sit debilior; et sic deinceps, continuata serie, donec ad maximas tandem deveniunt particulae illarum, e quibus operationes chymicæ, et colores corporum naturalium dependent.

Optice, edit. lat. aut. Is. Newton, equit. aurat. p. 337.

“and so on in a regular progression to the
 “largest masses, &c. upon which, says he, the
 “operations of Chemistry and colours of bodies
 “depend.”

The difference between them, it must be acknowledged, is not very perceptible at first, from the similarity of one of their laws, already touched upon; but their effects extremely unlike in every other circumstance of their action; neither is it referrible to any of the rest. For, notwithstanding that power whereby the periodical revolutions of those stupendous bodies, the planets, are regulated, and the solar system directed; whence, amongst other things, are derived the orderly and necessary return of seasons to different regions and climates of the habitable world, with their concomitant advantages, as well as that which assists the mariner in his passage through the trackless deep; gives firmness to solid substances; and is excited by friction or warmth is attraction. These several species of attractive virtue, whether subject to stated laws, respecting their distance, as gravity; confined to a particular body, as magnetism; attracting or repelling only light substances at sensible distances, as electricity; or contributing to the rise of sap in plants; and acting, in general,

neral, upon the integrant parts of matter alone, have no considerable share in chemical or natural phenomena, where the constituent, and not the ultimate particles of mixt or compounded substances alone are the object; and such alterations, in the properties and peculiar qualities of the less compound bodies, induced, by combining them together, as sufficiently prove the existence of another order of attraction.

In the commixture of a vegetable lixiviate salt, and the spirit, usually called oil of vitriol, which, separately, imbibe aqueous fluids copiously, less eagerness is discovered in them to dissolve in the same menstruum when united. And the suffocating marine acid, when uncombined, is of a remarkable elastic and incoercible nature; but, if combined with a fossil alkali, it is hardly to be disunited again, without the addition of one of the stronger acids.

But that the reader, however unconvertant in this kind of reasoning, may not pass unsupplied with necessary data to assist his enquiries, which can hardly be prosecuted through the experimental part of this essay, short as it is, without some idea of the principles it rests upon; it will not be amiss, premissively, to give a succinct

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succinct account of the nature of this species of attraction and its laws, as they will be infinitely serviceable in pursuing our subject thro' the various classes of chemical substances. For none of the experiments upon compounded bodies, and very few, if any, of the rest, it is evident, can be well described, or a reason assigned for different appearances observed in our trials of the common medicines of the shops, if not tolerably acquainted with some singularities, which distinguish this from every other order of attraction. Nor indeed can a methodical investigation of artifices be proposed to the novitiate, except by means of this medium of chemical alterations.

And the gentlemen of our own island, who have undertaken to give lectures upon the theory and practice of Chemistry, sensible how prejudicial an omission of this kind might prove to the art, have been particularly attentive to the subject; and carefully noted the difference between this and every other species of attraction, especially the attraction of cohesion; remarking, with the mechanicians, that cohesion, in the first place, is strongest in these bodies that touch one another in the greatest number of points; instanced in the force required to
separate

separate two leaden balls twisted together, and cohereing, contrary to the power of gravitation, in proportion to the points of contact: reminding us at the same time, that if there be any intervening particles of dust or other extraneous bodies, to prevent their touching in a sufficient number of points, the effect will be totally destroyed. And next, that all bodies whose component particles are in the closest contact, or touch one another in the greatest number of points, have most matter in a given volume, as gold, silver, or any other metal, in comparison of wood, feathers, cork, sponge, or fluid bodies: and are therefore said to be specifically heavier, or which is the same thing, to cohere more strongly, and demand a superior force to disunite or break them asunder, than the particles of fluids, or less compact solids, which must of course have fewer touching parts: whence it follows, say they, that all substances cohereing, or touching each other in a fewer number of points, or, to speak less philosophically, lighter bodies should not, from what has been premissively advanced relating to the settled laws of cohesion, be able to separate the denser; or in other words to break those to pieces which are heavier or more compact than themselves.

This

This consequence, nevertheless, arising from the nature of the attraction of cohesion, whereby the minute particles of bodies are connected or joined together, so as to form the firmest substances, as stones, metals, gems, &c. is contradicted in the numerous productions of the chemists, by a thousand experiments equally convincing; out of which it will be sufficient to produce one in the process for making the ordinary green vitriol employed in dying.

Iron, a body more ponderous than any fluid in nature, except running mercury, if exposed to a dilute vitriolic acid, is readily dissolved by it. But this metal, almost four times heavier than a well-concentrated acid of vitriol, must have its constituent or its ultimate particles, in firmer contact than those of the spirit, according to what has been premised in general concerning the nature of cohesion; *i. e.* their particles must touch one another in a greater number of points; or, in more explicit terms, it must have fewer vacuities, or empty spaces in proportion to its superior density, than the acid solvent, which acts upon it, and be, consequently, incapable of decomposition by the lighter fluid. And yet this dilute acid, in comparison of what is known amongst practical chemists by the name

of

of oil of vitriol, though remarkably less dense than the metalline substance designed to be dissolved by it, immediately divides the constituent parts of the more compact mineral; and with incredible readiness; rapidly throwing off the inflammable part of the iron in vapour, as evinced by the explosion observed, during the operation, upon applying a lighted candle to the steam. The ferrugineous molecules, in the mean time, are uniformly suspended in the acid liquor, so as to form a fluid apparently homogeneous; and constitute, when crystallized, a new compound *copperas*, or green, often called in preference, *Green vitriol*, though inferior in quality to the *English*, for several purposes; and particularly where copper, which makes a part of almost all that is imported upon us, may be disserviceable to the tinging property, or medicinal qualities of the ingredient.

Copperas then, or green vitriol, which consists of the calx of iron, acid, and water in large quantities, being specifically lighter, in its mixt state, than the iron alone before it was dissolved, and abounding, of course, with more pores or vacant spaces, than the metal before it took its saline form, or was converted into crystals, furnishes a strong proof in favour of the fundamental

mental postulate of the Chemists, which supposes a material difference between that species of attraction, considered as the medium of almost all chemical operations, and that by which the parts of bodies are said to cohere or stick together, and acquire density as well as firmness.

Besides, the attraction of cohesion was never imagined to extend its exertion beyond the integrant parts of bodies. But the power contended for by the Chemists is known to affect their constituent or component molecularæ in a remarkable manner; so as to become the agent of numerous alterations in their internal texture, exclusive of what is asserted by mechanical philosophers; from whence it follows, that notwithstanding this may be deemed a species of the universal affection of matter, so frequently taken notice of already, and of which we shall have occasion to observe more hereafter, in applying the present doctrine to an examination of artificial concretes, there is no reason to think it the attraction of cohesion; seeing it is invested with very different powers, and is not subject to the same laws: except it may be urg'd, that there is some kind of analogy between them in regard to their spheres of activity, being each so infinitely

finitely little, as hardly to exceed the point of contact. In every other respect their virtues are apparently dissimilar.

Such a conformity, however, of one of the laws of chemical attraction, to what Dr. *Desaguliers** observed relating to the ratio of increase or decrease of the attraction of cohesion, supposed to diminish “in a biquadratic ratio of the increased distance; that is, at twice the distance to act sixteen times more weakly; and at three times the distance, eighty-one times more weakly, &c. because it becomes insensible at the least sensible distance,” inclined the first promoters of philosophical Chemistry to consider them as one and the same. And in order to support this opinion, some false consequences were drawn to favour an hypothesis of dissolution, or uniform suspension of metals and metallic substances in acid menstruums, so as to produce a fluid apparently homogeneous.

And notwithstanding the arguments which have been adduced to resolve these alterations of the Chemists, as well as other appearances observed in uniting the elementary parts of natural

* Course of Experimental Philosophy, 4to, Vol. I. p. 16.

natural substances into one general attraction of cohesion, the necessity of another species, whereby some bodies are disunited and separated from their solvents, or others formed by the mutual coalition of their constituent particles; from whence arise substances totally dissimilar very often to either of their component parts, is amply evinced by a train of facts from our own pharmacopœia, as in sulphur præcipitatum, or lac sulphuris; and the antimonial caustic, or butter of antimony, with its cinnabar; making together, when attended to, but one Process.

The acid spirits of salt, and nitre, especially if made after *Glauber's* manner, which is chiefly in practice at present; the manner of producing the ordinary smelling salts, and the bad use which is made of the residuum; corrosive sublimate prepared according to the common process; *Rockelle* salt, soluble tartar, and the vinum aloeticum of the college, &c. are further proofs of the same truth.

This last composition, from its volatile pungency, and another circumstance, not quite so obvious, proves a decomposition of the sal ammoniac, and the production of a substance used no where in medicine, except in the preparation before us, by means of the lixivate salt; namely

the digestive salt of *Sylvius le Roe*, if that was meant by the process, in consequence of a coalition between the marine acid, one of the constituent parts of sal ammoniac, and the vegetable alkali.

Again, sulphur is less inclined than any of the acids, to unite with lixivate salts; and therefore liver of sulphur, or its solution in water, may be decomposed by any acid whatever, which will unite with the fixt alkali, form therewith a neutral salt, and let go the sulphur. Hence, if flowers of sulphur be boiled with three times their weight of quick-lime, till they are perfectly dissolved, the solution filtered thro' paper, and a weak spirit of vitriol added, the consequences just mentioned will succeed; and a pure preparation of sulphur be obtained for medicinal purposes, which is usually kept in the shops, and was called, from the colour it gives to water in precipitating, milk of sulphur; but this name is now very properly exchanged for precipitated sulphur by the college of *London*.

Some curious results of the pharmaceutical kind, from a commixture of corrosive sublimate and antimony, or turpeth mineral and decrepitated salt, are likewise brought to prove
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the reciprocal analysis and coalition of the constituent parts of these bodies; and to illustrate in some measure the chemical expression of double elective attraction, by two familiar examples in the common process for making butter or oil of antimony with its *cinnabar*, and the corrosive sublimate of the shops.

One pound of antimony and two of sublimate, according to our own dispensatory, being separately reduced to powder, well mixed together, and afterwards distilled in a gentle heat of sand, produce an icy butyraceous substance which rises into the neck of the retort, liquifies when exposed to the air, and is known in the shops by the name of butter of antimony. And the residuum of the foregoing process, sublimed with an open fire, forms the true cinnabar of antimony; part of which appears in beautiful stræ, like highly polished needles: a phenomenon ascribed, by some old chemical writers, to a peculiar property in the sulphureous part of antimony, to give it this appearance.

For a clearer account of the reason of these variations, it is to be remembered that the distinct parts of sublimate are spirit of sea-salt and quicksilver, or mercury; and that crude

antimony, sold in common for the farrier's use, consists of a metallic substance and brimstone; which is all the subsequent solution requires to be known in respect of these bodies. But butter of antimony is formed by the combination of a marine acid with regulus of antimony; and cinnabar is the mere coalescence of quicksilver and sulphur. Acid of sea-salt then applied in a dry form to the antimony, as directed above, and assisted with a moderate heat, quits the mercury to unite with the regulus, which attracts it more powerfully than either the mercury or sulphur; and is volatilized by this union; and raised, without much fire, into the neck of the retort: whilst the mercury, deserted by the marine acid, unites with the remaining sulphur, and makes an æthiops, similar to what is employed in making factitious or artificial cinnabar; but being further urged with a strong fire, till it reaches the upper part of the vessel, it is converted into cinnabar of antimony, said by some chemists to be a crystalline concretion, effected in these two bodies, mercury and sulphur, as they become solid from a state of vapour.

On account of the force necessary however to sublime this mercurial mass, the college of physicians

physicians were induced to divide these two results into distinct processes, though but one in effect; since, with a little address, the experiment may be conducted thro' each degree of heat, without changing the retort, or removing it from the fire.

The present method of preparing *mercurius sublimatus*, in a large way of business, from decrepitated sea-salt, and quicksilver corroded with the acid of vitriol, furnishes another instance of what the chemists understand by double elective attraction, effected by means of a mutual chemical attraction between the component parts of these two bodies. For this composition, much more simple than the common process, exposed to a strong sand-bath heat for some time, after being intimately mixed together by long rubbing in a mortar, the acid of vitriol is detached, by the force of the fire, from the mercury it had corroded, and unites with the alkaline part of the sea-salt; and thereby disengages the marine acid from its natural base; which acid, thus superseded, immediately fastens upon the deserted mercury, and carries it, in a white crystalline form, called sublimate, to the upper part of the bolt-head, or subliming vessel; leaving behind a fixed neutral substance,
that

that proves, when depurated and crystallized, the true sal mirabile of the celebrated *Glauber*, constituted of the acid of vitriol and a fossil alkali.

Hence we have an indisputable evidence of the existence of an attractive virtue in the minute molecule of compounds, invested with particular properties, unknown to the natural philosophers; whereby we are enabled to imitate, alter, and destroy the natural connection of several bodies; to form new substances; to examine their elementary parts; and to project methods of Investigation for discovering the genuineness of medicinal preparations: very distinguishable nevertheless from the attraction of cohesion, as well as from the rest, in a variety of instances; though no where more satisfactorily than in the influence of this species of attraction on the elementary parts of mixt or compounded bodies.

For the mechanical division or alteration of natural substances was never observed to affect their internal structure, so as to vary their medicinal powers. Let nitre, sea-salt, or vitriol be reduced to an impalpable powder, mingled with one another, or with other bodies, in a liquid form, wherewith they have a tendency
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to unite in their compound state, or be even exposed for a short time to a strong heat, no change ensues in the mechanism of the concrete; that is, on its constituent parts. Salt-petre in particular may be boiled in a red hot crucible for a while, if defended from the fuel, and suffer little or no diminution*. But no sooner is the sea-salt or nitre touched with the naked acid of vitriol, tho' diluted with water, than its component parts are disjoined, and suffocating fumes, which are the true acid of salt-petre and sea-salt, rise out of the mixture, and leave, if urged with a moderate heat, the arcanum duplicatum, and Glauber's salt, in a dry mass, at the bottom of the vessel.

These facts supply with us with hints for enquiring into the purity of salt-petre, which has been some times suspected. Since this saline body consists of a volatile, suffocating acid, that emits red fumes very copiously, and a fixt base,

* It seems probable from some experiments, that the acid of nitre may be separated from its base, though slowly, without addition, in a heat sufficient to make it boil, as may be observed in making sal prunel, before we begin to inject the sulphur; and Dr. Vogel has a note to this purpose, where he says, *Depurari nonnulli jubent nitrum fusione. Non ita verò proficuum censendus est is modus, cum nitrum nonnihil de suo acido inter fundendum amittit.* Institut. Chem. p. 307 n.

base, which unites more readily with the acid of vitriol, being of the first order of the acid genus, than with its own, a decomposition follows; and the volatile acid of nitre thus disengaged, escapes into the air, and gives out an offensive suffocating smell. A suspected piece of nitre therefore being powdered, and a little vitriolic acid poured upon it, if none of these red vapours appear to rise out of the mixture, it may be pronounced spurious.

After what has been thus premised, in regard to the attraction of cohesion, it will not be necessary to take up much of the reader's time in shewing particularly wherein this attractive power of the Chemists differs from gravitation, which is a mechanical virtue, and inherent in all matter; whence two bodies approach one another under a settled ratio; all sublunary bodies gravitate towards the centre of the earth; and the planetary system is kept in due order: nor how distinguishable from magnetism or electricity, which are looked upon as chemical powers; being only inherent in particular bodies, though both of them differ materially from that attraction adopted by the Chemists; for the first requires friction, and a dry atmosphere to excite
its

its action*, and the effects of the other are limited to a single substance, as iron.

It will be worth noting, however, that particular concretes have a chemical attraction for some bodies, but not for all, as observed by *Macquer*, and other rational Chemists. Camphire and alcohol, it has been remarked, have a chemical attraction for each other, camphire and water have not. Lixivate salts and water have; but lixivate salts and alcohol have very little, and sea-salt has none; neither has a strong ley made of pot-ash and water, or the ol. tart. per deliquium much, if any. This proves, in opposition to what some have insinuated, that chemical attraction does not depend upon the size or configuration† of the particles of the menstruums, nor upon their being adapted to

* A gentleman observed of a small mariner's compass inclosed in a brass-box, into which was fixed a piece of glass, as a covering or security; that after being some time in his pocket, in a moderate warmth, the needle would not traverse, but attached one of its poles to the interior surface of the glass, till freed by the application of a little moisture or dampness, which converts electric bodies into conductors of electricity. Hence it appears that the power of electricity may be excited a little by warmth, sufficient to dissipate the humidity of the atmosphere, without any sensible friction, provided the electric body be not over-heated.

† See page 87.

to the pores of the solvend. For was it so, that menstruum whose particles are the smallest, should, in the first instance, be able to dissolve all bodies; which is not the fact. Alcohol can dissolve camphire, because the particles are the smallest, we'll say, existing there; why not then dissolve fixt alkali or sea-salt, when water, whose particles are larger, very readily dissolves them? And incinerated salts, it is well known, attract watery particles floating in the air very powerfully, whence the lixivium tartari.

Hence may be deduced a reason for the use of fixt salts in preparing the best alcohol; as the water contained in ardent spirits is attracted by a vegetable alkali, and the alcohol thence deprived of great part of its aqueous principle. This process, however, is not sufficient of itself to make an alcohol fit for varnishers, clock-makers, or other artificers, who employ it in making varnishes for the metal-faces of their clocks, and several ornaments of the like kind, which are liable to be corroded by any acrid substance, unless further depurated, by adding a little powdered alum to the tartarized spirit of wine, and distilling it afterwards, with a gentle heat, to separate it perfectly from the alkaline salts, which were suspended in the spirits. Whence

we

are furnished with another proof of the chemical result, usually called simple elective attraction.

The great utility of cleaning alcohol, or highly-rectified spirits after this manner, is very evident, and may be clearly accounted for upon the foregoing principles.

For the component parts of alum are a vitriolic acid and earth: now this acid having a stronger tendency to unite with a fixt alkali than with its own base, as experience evinces, leaves the aluminous earth to join the lixivate salt, and constitutes, by such coalescence, a true tartarum vitriolatum, not soluble in alcohol, leaving the earth, which made a part of the alum, and perhaps a portion of the alum likewise, unanalysed at the bottom of the vessel; because no more alum will be decomposed in this process, than what is required to neutralize the fixt alkali. An advantage not easily attained by the use of any unbridled acid, as the exact point of saturation whereon the success of this operation depends, will be found extremely tedious and difficult to hit. The substances produced then by such decomposition and new union, are a fix'd earth and enixated salt, void of volatility, together with a small remainder of
alum

alum unanalysed. But since these several bodies are incapable of being carried over the helm by the heat of a *Balneum Mariæ* at least, an alcohol, or highly rectified spirits of wine, will be procured, of course, by a subsequent distillation in proper vessels, free from all heterogenities of the saline sort, which might prove detrimental, not to the menstrual power of the spirit, as a resinous dissolvent, but in regard to its effects on some varnishes, that it would make unfit for several practical purposes, by soon rendering the work unsightly.

Endless examples are to be found amongst writers of this class, to confirm the general consent of the chemists relating to a fifth species of attraction, considered as the medium of various combinations and resolutions of pharmaceutical substances, whereby the constituent parts of compounded bodies are divided, and numerous properties and affections of matter, in the more simple or elementary parts of several natural or artificial concretes, discovered and applied to different intentions, in the way of officinal preparation; witness the formation of neutral salts, their analysis and reunion: and the variety of saline bodies to be met with nowhere except in the laboratories of the Chemists.

Few

Few or none, however, have hitherto adapted the same serviceable principle to a careful examination of the substances thus produced; though it seems to promise equal advantage, as a medicinal art, to the individual. For be the prescriber ever so capable, what success can be promised from the most judicious applications, if unseconded by the pharmaceutical operator? The mischiefs and disappointments, nevertheless, attending a fraudulent or ignorant manner of preparing different tribes of medicaments, usually kept in the shops, will dwindle, it is presumed, in proportion to the growth of this branch of chemical knowledge.

When gentlemen are furnished with means, neither tedious nor expensive, to try the genuineness or perfection of shop medicines, in a general way, venders will presently find their account in an undisguised practice, and dispensers be made happy in the possession of a medicine to be relied upon; and this must naturally follow, when the art of detecting such abuses is once thoroughly understood. But how, say some, can all this be effected? What plan of experimental enquiry can be projected, that will not, after all, take up a great deal more time, where

where avocations are frequent, than can be well spared to answer, fully, the beneficial ends proposed?

In the subsequent pages we shall be able, it is hoped, to shew the absolute practicability of such an attempt, and the great probability of forming rules for examining many chemical substances with expedition, ease, and accuracy enough for medical purposes; and also to account for the several appearances and results, by a due application of the fundamental truths already premised; without exposing the common artifices of reduction, as hinted above. *

That it is very sufficient to be well guarded against imposition must be admitted. Our acquaintance with the various ways of sophisticating, or the dexterity of substituting one thing for another, much better abolished than promoted or connived at, is an unnecessary accomplishment. And persons who cannot avail themselves of the practice, when known, any further than to *detect* abuses of this cast, will hardly think well of time mispent in useless information, be it ever so small; neither is the author any ways inclined to insert particulars directly apposite to the meaning of his essay, or to recite inventions,

inventions and measures in use, to give similar appearances to things different in their natures; as in substitution; or to preserve the figure of a reduced preparation well enough to elude our senses; as in the subtle commixtures or additions of sophisticators, who pay very little regard to consequences.

The sole intension of the present work is to shew, by regular and short trials, deduced from a knowledge of some of the peculiar properties of medical substances, natural or artificial, how to discover frauds, by the means of particular additions, or other methods, which will divide them, if mixed, as in sophistication they must be, and expose the deceit. For instance, essential oil of anniseeds unites freely with alcohol, or highly-rectified spirits of wine; but, sophisticated with a particular body, it will not. Cinnabar, native or factitious, may likewise be almost wholly dissipated by a proper degree of heat, on account of its volatility; a faculty belonging to no body wherewith this substance can be reduced for medicinal purposes, or as a pigment: and a solution of sal martis, or the salt of steel, in water, if free from any particles of copper, will not become turbid upon immersing a bar of iron or steel into it, but if adulterated with this metal it will.

From these premises then, the office of detecting artifices in medicine does not seem totally out of the reach of philosophical Chemistry. Supposing our plan defective, therefore, in a variety of particulars; should gentlemen of superior abilities, or more leisure, be excited, from any hints contained in this short tract, however imperfect, to undertake the subject, and contribute their share towards making this kind of inquiry a necessary part of the study or practice of pharmacy, as it ought to be, seeing it tends no less than the rest to answer every physician's views, by advancing the credit of the profession, and adding a little to the patient's security, the author will think himself happy in having started a notion not totally unworthy of pursuit; and one which cannot fail of proving, when complete, an acquisition of infinite use to the public.

Tho' chemical writers seem agreed at present, that there is a mutual conformity, affinity, or attraction amongst the constituent or elementary parts of bodies, whereby the principal phenomena of Chemistry are to be explained; they are not so unanimous in the use of a term intended to signify the cause of these appearances or effects. The word *affinity*, chiefly employed by the best writers upon this subject,

has

has been particularly objected to, * “as being
 “very improperly applied to this meaning:
 “and tending to breed confusion and error in
 “the early notions and conceptions of those
 “who may enter on the study of those subjects;
 “and who must be unavoidably misled, by the
 “original sense of the word, to draw false con-
 “clusions from the use of it. For affinity, it
 “is said, must be understood to imply some
 “sameness or agreement of nature or kind in
 “the bodies betwixt which it is said to subsist:
 “whereas the specific attractions, which are
 “what is miscalled by this name, will be found,
 “for the most part, to be exerted by those
 “bodies, on each other, that are the most dif-
 “ferent in their general nature; and instead of
 “agreeing with each other in their qualities,
 “have those that are the most opposite, and
 “which, by the very action that is owing to
 “this principle, they mutually destroy in each
 “other on their combination.”

And yet some compounded bodies, it is to be
 observed, are easily separated by the addition
 of a third body which would, singly, demand a
 strong fire, whereby the mutual attraction of
 its component parts may be absolutely de-

* Institutes of Experimental Chemistry, Vol. I. p. 40.

stroyed, as in nitre and sea-salt. This power then, call it by what name you will, indisputably proves a superior tendency or inclination in one of the compounding parts of the mixed body, to unite with the superadded substance, than with that body whereto it was previously connected. The *pulvis algorath*, or *mercurius vita*, mentioned by *Macquer**, is produced by merely weakening the attraction between the concentrated muriatic acid and regulus of antimony, as the process evinces, which directs the additament of a little warm water for that purpose, and shews the power of attraction betwixt the concentrated acid and water superior to the attraction that prevails between the same acid and regulus under this form; whence the event. And this conclusion is considerably strengthened in the manner of procuring the same substance, only by exposing *butter of antimony* to the common air, from whence it attracts the moisture, and deposits at the same time a white sediment like the former. The liquor too concentrated by distillation, being in reality a spirit of salt, is called improperly philosophical spirit of vitriol,

Hence then it seems as if the term affinity, though it does not appear to be so determinate,

or

or applicable to the cause of these and other variations or changes in the constituent parts of bodies, which come under the chemist's inspection, as *chemical attraction*; it may be made use of occasionally to supply its place, as conveniently and properly at least as the epithet *specific* prefixed to attraction, which includes some other appearances, besides chemical, taken notice of by philosophers: as the particular effects of the magnet, and excited tube or sphere; but these differ materially, for reasons already produced* in the former part of this work, from that attractive virtue which exists invariably, however suspended or prevented by intermediate forces for a time, in the minute and elementary particles of matter, and form that distinct species which the Chemists have adopted, neither destructible nor variable, like magnetism or electricity, by fire or water; nor confined to the integrant parts of compound substances, like gravity or cohesion; but subject to particular laws laid down by Dr. *Macquer*† in seven propositions: of which two are of use in the design before us.—And first,

“If one substance,” says this author, “has any
“affinity or conformity with another;” that is,

I 3

if

* Page 107, 108.

† Elements of the Theory of Chemistry, Vol. I. p. 12, 13.

if two substances are endowed with a chemical attraction for each other, "they will unite together and form one compound."

And next, "If a body consists of two substances, and to this compound be presented a third substance *that has little or no affinity with,*" or chemical attraction for "one of the two primary substances aforesaid, but has a greater affinity with," or chemical attraction for, "the other than those two substances have for each other, there will ensue a decomposition and a new union; that is, the third substance will separate the two compounding substances from each other, coalesce with that which has an affinity with," or chemical attraction for, it, form therewith a new combination, and disengage the other, which will be left at liberty, *and such as it was before it had contracted any union.*"

The conclusion of this last proposition, however, is not strictly true; for decomposed bodies do not always produce the substances, which are sometimes calcined by acid solvents, the same they were when exposed to their influence, as we have already shewn. *

From

* Page 93 in the notes.

From what has been thus premised then, relating to a fifth species of attraction, and some of its particularities, the practicability of applying the present doctrine of Chemistry, founded upon a reciprocal tendency of the minute particles of matter to unite with one another, will be attempted, in order to evince its utility, as proposed, in the examination of chemical productions; and to shew the possibility of accounting for these several results upon the same principle generically, which did not succeed, for want of due restrictions, with those Chemists who had employed it too indiscriminately, it must be owned, in the solution of some of their phenomena; before there was any possibility of being supplied with experiments sufficient to point out the difference between the four species of physical attraction, and that which lays the foundation of all our reasoning in the chemical science.

If the structure of artificial bodies, and the steps of each process, with their events, be once tolerably understood, the difficulties attending an enquiry into their genuineness must soon vanish. For, admitting the truth of what has been previously advanced, a preparation can be no sooner offered to the Chemist acquainted with

with the speculative as well as practical part of of his art, than their component particles and some of their properties, which have been the object of his attention, present themselves.

Suppose a simple volatile spirit, for instance, offered to sale: besides the necessary marks of purity, obvious to every vender, the rational Chemist, apprised of the principle whereon its perfection and medicinal efficacy depend, applies his proof accordingly; from a knowledge of the effect which some known body will have upon that part of all saturated solutions of the milder animal salts, or upon such as are rendered extremely pungent by the addition of caustic alkalies.

When a set of tables then, framed upon these principles, shall be exhibited, specifying the constitence or component parts of bodies, where they consist of particles chemically combined together, with the characteristic, trial, and criterion of each, agreeable to the annexed plan or specimen, from whence the reader may form some idea of a more perfect work of the same sort, the apothecary, it is hoped, will meet with very little perplexity in his enquiries; every necessary circumstance being traced in a manner

to his hand, and each event, as far as it may be wanted for medical ends, particularly noted. And this it is wished may be so fully made out in the subsequent recitals, as to leave no doubt of its certainty, or of the probability of carrying these researches, with as much accuracy as the nature of the subject demands, through the greatest part, if not through all the different classes, of chemical remedies.

EXPERIMENT I.

Having taken a dram, or sixty grains, of prepared factitious cinnabar, and exposed it in a common fire-shovel to a pretty strong heat for some minutes, the whole was dissipated in effect; nothing remaining upon the shovel, except a very small quantity of powdery substance of a greyish colour, and of a slightly austere taste.

I then placed, upon the same shovel, as much of ordinary Dutch vermilion, or what was so called, which ought to be nothing more, tho' prepared for the painter's use, than true cinnabar finely levigated; and should therefore, *ceteris paribus*, exhibit the same appearance. But this, on the contrary, left a large residuum of a dirty red colour, after being submitted to

a stronger heat than the former, for thirty minutes or upwards.

SOLUTION.

This preparation, consisting of something more than two pounds, troy-weight, of mercury to seven ounces of sulphur, is made into an æthiops, and then sublimed in the form we have it in the shops. Hence it appears that the chemical attraction of these two bodies for each other being too powerful when united, as in the æthiops, to be overcome by a degree of heat sufficient to volatilize either of their elementary parts, they will be carried up, in their combined state, to the upper part of the subliming vessel. And for the same reason, when submitted to a like degree of heat, upon any future trial, the same consequences will ensue, and the cinnabar, without a proper apparatus, be wholly scattered in the air; or if separated in any degree, as will sometimes happen, where the experiment is pushed on a little too hastily, there will be a small residuum; which seems to be nothing more than a very inconsiderable portion of mercurial calx, not much unlike that substance, found at the bottom of the retort in rectifying strong spirits of vitriol. Hence genuine vermilion or cinnabar

nabar, the experiment instructs us, is a volatile substance, capable of being dissipated by a proper degree of heat, and is thereby distinguishable from that sophisticated sort which consists of both fixed and volatile parts.

OBSERVATION.

It is said there is another method of adulterating vermilion, not discoverable by this trial; but the specific gravity will be much lessened by such an addition, and the cheat may be thence detected: or its component parts may be disunitd, and the mercury recovered in its virgin form, whence it may be known whether the quicksilver was in due proportion. This, however, is a circumstance of little or no moment to the medical effects of the preparation, and too tedious for extemporaneous purposes.

EXPERIMENT II.

Having taken a small quantity of true oil of aniseeds, and about as much of a sophisticated sort, which would retain its fluidity in a warm season; to each of these I poured an equal proportion of highly-rectified spirits of wine, or *alcohol*; shook them well together, and then let them stand quiet a while to observe the effect.

With

With the first the spirits mixed like water, constituting a liquor apparently homogeneous, but precipitated, from the adulterated oil, a white, flocculent, fatty substance, which had been added to it for purposes there is no necessity to mention. And in order to try the power of alcohol alone upon the residuum, when freed from that compound fluid, the liquor was cleared off with great care, and fresh alcohol added to the separated substance, but without making any alteration.

SOLUTION.

Since there is a tendency in the oil of aniseeds to unite perfectly with other bodies besides rectified spirits of wine, it is capable of being reduced, as in the present experiment, without injuring the look of it. But as this oil contracts an union with alcohol more readily than with several bodies, wherewith it may be combined; by the addition of highly-rectified spirits, another compound is produced, which has no chemical attraction for the substance wherewith the oil had been previously mixed; and therefore leaves it to subside or emerge in the new-formed liquor, according to its relative gravity; neither has alcohol alone any affinity for the sophisticating part of our oil, as the conclusion of this experiment evinces; whence follows
the

the reason why no alteration in the appearance of its residuum, or precipitated substance, is induced by the spirits of wine.

OBSERVATION.

The experiment before us has been carried a little beyond the limits necessary for examining into the genuineness of medicinal substances; for the sake of shewing, that altho' all bodies, agreeable to what has been premised, are allowed to have a chemical attraction for some particular substance, there are others for which they have none, as instanced in this process. And it is to be remarked also, that this, like many more of the essential oils, is liable to be adulterated various ways, which it would interfere too much with the scope of our design to recount; since nothing more is intended here than to evince *a possibility of applying the present theory of Chemistry to a reasonable solution of experiments, in proof of our proposition, which supposes chemical attraction no less serviceable in detecting impositions, than in other branches of pharmaceutical Chemistry, under due restrictions.*

EXPERIMENT III.

Having put into different glasses about the same quantity of a saturated solution of counterfeit

perfect and true *Glauber's salt*, a strong lixivium of pot or pearl-ashes was poured gently into the first; when, without shaking, or any other means, a white, curdly substance was produced, which divided itself from the aqueous fluid, and subsided to the bottom of the vessel; but as much of the same lixivium being added to the other solution, which was stirred and well shook together, no apparent separation ensued at first, nor the least milky cloud was observed to form itself in the menstruum; although the component parts of this salt were disunited equally with the fictitious kind above.

SOLUTION.

The constituent parts of true *Glauber's salt* are natron, or a mineral alkali, and the acid of vitriol: the spurious kind is a combination of mild absorbent earth, and the same acid. These, it is known amongst Chemists, may each of them be decomposed by the stronger chemical attraction of vitriolic acid for vegetable alkali, than for natron or mild absorbent earths. Fossil alkali, however, is soluble in a small quantity of water; and has likewise an affinity to, or chemical attraction for it, tho' impregnated with particles of vitriolated tartar, produced in the analysis of each salt. The

natron

natron therefore of the genuine salt will be suspended in the compound fluid, whilst the earthy substance, truly precipitated from the other sort, having no affinity with, or chemical attraction for, water or watery liquors of the alkaline or neutral kind, will not continue suspended in it, but gradually subside, as the experiment demonstrates.

OBSERVATION.

In Dr. Heberden's account of a salt found upon the *Pic of Teneriffe*†, it is observed, *that vegetable alkali has a stronger affinity to the acid spirits of vitriol, nitre, or marine salt than the fossil.* * “For if the common alkali be added
 “to a saturated solution of true *Glauber's salt*
 “in water, the spirit of vitriol will leave the
 “natron, and, uniting itself with the vegetable
 “fixed alkali, will form vitriolated tartar; which
 “being of difficult solution, much of it will
 “crystallize ‡ and fall to the bottom, while the
 “natron, robbed of the vitriolic acid, remains
 “dissolved,

† Philosophical Transactions, Vol. LV. p. 59.

* *A salibus lixiviosis, e vegetabilibus confectis, præcipitantur:*
Vogel. Institut. Chem. p. 271, sect. 575. N^o. 3.

‡ This, it is to be noted, depends upon the quantity of water employed; which, in the Doctor's experiment, is understood to be limited to the point of saturation in both solutions at least.

“ dissolved, together with a small portion of the
 “ vitriolated tartar.”

Natron being a species of alkali extremely soluble in water, or watery liquors, but less so than the vegetable, its separation, or what the Chemists call precipitation, will not be succeeded by a sediment, or visible disunion of the deserted alkali. Hence we learn the great impropriety of a term, much in use amongst chemical writers; and hence it appears too, that the celebrated *Vogel* has omitted a circumstance of consequence, in his definition of this operation †, which sometimes evidently includes suspension or dissolution of a separated substance in the fluid menstruum, as well as the mentioned effects. For in the experiment before us, the fossil alkali, said to be precipitated, or separated from the vitriolic acid, for these are synonymous terms in Chemistry, is truly dissolv'd in the water impregnated with vitriolated tartar; whilst some part of the new concrete, consisting of strong acid of vitriol and vegetable alkali, is found adhering in a crystalline form to the sides or bottom of the vessel, and thence seems to be the precipitated substance, which is not truly the fact; so that the common
 idea

† See page 94 in the notes.

idea of precipitation, even as delivered by Dr. *Negal*, cannot fail of creating confusion sometimes in our notions of this operation; and must therefore frequently lead experienced practitioners into false conclusions, if unacquainted with numerous errors observable in the appellation of this mode of analysis, which would not take up much time to correct, were operators a little more circumspect in their enquiries than we generally find them; or authors not quite so hasty in applying terms of art to the various effects of particular bodies upon one another, in a state of vapour or solution; whereby the constituent particles of natural concretes are disunited, new substances formed, and a number of changes, dependent upon the superior attraction of a particular body, for one of the elementary parts of a mixed or compound, than for the other discovered; whence we obtain our ideas of elective attraction as well as precipitation.

EXPERIMENT IV.

Having immersed a thin plate of iron, free from rust, in a saturated solution of genuine *sal maris*, it made no impression upon the fluid: but the same plate taken out of this liquor, well wiped and dried, and then dipt into a solution of another kind of salt of steel, the menstruum

presently discovered a change; and let fall a little dusky sediment upon the surface of the immersed plate, which being carefully brushed off, sunk gradually to the bottom of the vessel.

SOLUTION.

Acid spirits, particularly those of vitriol, employed, as the college directs, in making the *sal martis* of the shops, unite, it is known; though not so generally as nitrous acid, with other metalline substances as well as iron; but much less readily with the body usually found mingled with crystals of iron, than with iron itself. Hence, if *sal martis*, impregnated with any of these particles, which is sometimes the case, be dissolved and exposed to the influence of another body, iron, for which the vitriolic acid has a stronger chemical attraction than for one of the constituent parts of mixed salt of steel, the heterogeneous body will be deserted by that part of the menstruum which had dissolved it, and unite with the ferrugineous molecule, whilst the other body, thus deprived of its solvent acid, which was the bond of union between that and water, either falls to the bottom of the vessel by its own weight, or hangs upon the surface of the immersed plates or rods. Hence, in examining this medicinal substance
for

for the purposes of prescription, it is only required to dissolve a small quantity of the suspected salt of steel in fair water; and if, upon dipping clean iron rods, or bright plates of iron, into this solution, it remains totally undisturbed, you have a very sufficient proof of the genuineness of the substance, agreeable to the intention of our essay.

OBSERVATION.

As there is no substance in which trading Chemists are concerned that is more liable, either through carelessness or design, to have very pernicious effects on animal life than the body under examination, practitioners cannot be too accurate in determining its purity. The body wherewith it is most generally, if not always mixed, when of a bad kind, is of a remarkably virulent disposition in combination with vegetable as well as mineral acids. The most fatal effects are therefore to be dreaded from the sophisticated or substituted preparation at all times.

A memorable instance of this truth fell under my own notice, many years since, in a young person, who, to promote a menstrual discharge, had recourse to these salts, which were procured,

for cheapness, of a common retailer. Soon after taking the first or second dose, I do not particularly recollect whether, she was affected with severe reachings, &c. which could not be mitigated by any means. These continued, with very little intermission, for some hours, when a blood vessel of the head being strained or burst, as it was suspected, the patient soon became comatose, and in that state expired in about twenty-four hours, every probable method of relief having been attempted in vain by a physician of known abilities and eminence in his profession.

This gentleman, however, observing the violent operation of the substance, examined the small remainder, and quickly discovered a reason for its dreadful effects, which may be easily and effectually obviated by the proposed method of trial, insignificant as it may seem, perhaps, to persons unskilled in the nature of chemical combination.

EXPERIMENT V.

1. Upon an undetermined quantity of genuine *Magnesia Alba* in water, as much strong spirits or oil of vitriol were cautiously dropt, as neutralized the alkaline absorbent earth, which it dissolved

dissolved with a considerable effervescence; from whence it appears to be no caustic alkali, as some have insinuated. The liquor, by this union, acquired a disagreeable, bitter taste, without losing its transparency, or being at all discoloured from the saline body thus produced, consisting, as will be seen by and by, of a vitriolic acid, and absorbent earth.

2. I then took about as much, by guess, of a counterfeit sort, too frequently met with in the shops, and added a drop or two of the same acid. This continued unaltered by the powdery substance, preserving its acidity intire, and without inducing any change upon the concrete. But having poured some of the same acid upon common prepared chalk, it made a strong ebullition; lost its sour taste; and became, in all respects, similar to the preceding neutralized body; as experiments made upon these substances, in the analysis and re-union of them by the alternate affusion of *lixivium tartari* and vitriolic acid, evinced.

3. Having dissolved a little *Epsom*, or *Magnesia Glauber's salt*, as it has been lately called, in clean river water, and compared this solution with a dilute spirits of vitriol, saturated with the

best *Magnesia Alba*, they were found to agree in every point; the absorbent earth of each being precipitated, or dissolved, and the bitter taste of the liquor destroyed, or recovered at pleasure, by the same means.

SOLUTION.

To account for these appearances of *Magnesia Alba* and *Epsom salt*, from whence the criterion of genuineness is most readily deduced, it is to be observed, that the salt * which affords the greatest quantity of this substance, consists of vitriolic acid and absorbent earth; and also that vitriolic acid, having a superior chemical attraction for vegetable fixed alkali than for absorbent earth, deserts the earth, when fitly circumstanced, to unite with alkaline salt: whence the base of *Epsom salt*, which is true *Magnesia Alba*, being thus deprived of its native acid, whereby it is made soluble in an aqueous menstruum, and having no chemical attraction of its own for water, or water impregnated with vitriolated tartar, it is, strictly speaking, precipitated; but not always free from impurities.

Hence, perhaps, it was, that Mr. *Glass* took occasion to tell us, somewhere in his short tract, that

* See page 32, 33.

that *Magnesia Alba* was a *capricious* preparation; though this does not appear from a number of experiments; neither does it seem to correspond with the invariable laws of nature, or the universal opinion of speculative Chemists and philosophers, in respect to the constitution of mixed or compound bodies.

From these premises then a method may be laid down for examining the genuineness of *Magnesia Alba*, that will be ready, easy, and conclusive, if similarity of properties are a proof of identity. For suppose a neutralized solution of *Magnesia Alba* in vitriolic acid, agree in all its properties with another of *Epsom salt* in water, there can no doubt remain of their being constituted of the same elements.

OBSERVATION.

The excellence of genuine *Magnesia Alba* in destroying acidities, and its utility, on that account, to lax or weak habits, liable to those indispositions, shews the hazard, no less than the offence, of administering a spurious kind, upon which no acid, of whatever order, can induce any alteration, as in selenites.* This therefore is, of all contrivances, the most blameable. A mag-
gistry

* See page 36, 37.

gistry of chalk, as readily produced as the substance we are now speaking of, would have answered one of the prescriber's intentions at least; but they are here both effectually disappointed, by a *coup de maître*, which at once betrays an ignorance of chemical results one can hardly imagine; throws an odium upon the profession it will be difficult perhaps to remove; sinks the character of a capital remedy in several disorders of the *primæ viæ*; and bids fair to do irreparable mischief to those who shall suffer themselves to be imposed upon by this unaccountable device.

And since there have been great debates about the goodness and superiority of different preparations of this substance, to shew wherein its perfection consists, and to demonstrate at the same time another advantage arising from the present manner of enquiry, as well adapted to the comparison of faithful productions as to some other purposes, the subsequent experiment is added.

EXPERIMENT VI.

Having taken five grains of genuine *Magnesia Alba*, which was particularly soft, but neither remarkably white, nor dry, though free in every
other

other respect from heterogeneous bodies; and likewise an equal quantity of the *Oxfordshire* preparation, somewhat gritty, and harder than the other. These were each of them put separately into a table spoonful of water, and acidulated with thirty drops of the same spirits of vitriol. By the softer *Magnesia Alba* the acid was perfectly saturated, but it was very discernible in the other*. One grain more therefore was added, but the acidity still remained very perceptible. Hence it is evident that the *Oxfordshire* preparation, that at least which fell into my hands upon this occasion, had not above $\frac{1}{5}$ ths of the absorbent virtue of the other: Whence it is conclusive, without enquiring into the cause of a difference, obvious to every good Chemist, that the smoothest *Magnesia Alba*, if genuine†, is highly preferable, as a medicine, to the hard or gritty kind; and that weight, colour, and perhaps other adventitious circumstances, which some may have considered with great attention, are perfections of little or no moment, compared to a peculiar softness discoverable in the best *Magnesia Alba*.

As

* The *Oxfordshire Magnesia Alba* made use of in this experiment, was given me by a gentleman for the purpose of comparing it.

† The counterfeit *Magnesia Alba*, mentioned in this experiment, is remarkably soft; but this, it is to be remembered, is no proof of its being genuine.

OBSERVATION.

As the preceding experiment was chiefly made to give a criterion of the best *Magnesia Alba*, it would be impertinent to trouble the reader any further upon this head: our plan is only designed to promote an enquiry into the genuineness of chemical substances; not to compare one genuine preparation with another, which, Chemistry informs us, may be in many cases both practicable and useful, where their value principally depends upon being saturated with particular bodies, as in volatile spirits, tinctures, &c. or free from particles, either void of medical virtues, or invested with qualities of a different nature, which may weaken or counteract their several powers; for it is evident there may be a material difference, on this account, between two medicines of the same denomination, and that very discoverable by experiments of this kind.

After this manner might the subject be pursued through a great variety of chemical remedies besides, many of which are liable, like some of the preceding, to be reduced several ways; and thence not discoverable by the same application. But this being no part of our present intention, it is hoped enough
has

has been already said to illustrate and confirm the utility of our theory in explaining and examining its own productions; and to prove an undertaking of this kind not altogether impracticable. Altho' it is to be acknowledged that, in the reduction of particular substances by addition, where each of them have some similar properties, the same means will not always succeed. Factitious cinnabar, or vermillion, mentioned, *page 137, &c.* may be adulterated, as we are told, by a volatile as well as a fixed substances; whence heat alone, though it separates fixed substances from volatile, and is thus far effectual, it will answer in no other respect. Sal ammoniac, another body of the volatile kind, is frequently mingled with a particular preparation of value, wherewith it will both dissolve and sublime. If then the criterion of genuineness was to be sought for in either of these qualities, the enquirer would be disappointed. But there is another peculiar to it, by which it may be readily distinguished.

Chemical or distilled oils, in general, are lowered different ways: one of which, as taken notice of, *page 139, &c.* may be detected by alcohol, or highly-rectified spirits of wine; but this application does not extend to them all.

Magnesia

Magnesia Alba, in lump or powder, is often mixed with earthy bodies soluble in the acid of vitriol; the cheat therefore is not always discoverable by a mere affusion of this acid, tho' it succeeded in the experiment, page 149. It became necessary, therefore, as in the same page, No. 3, to compare it, in a neutralized fluid state, with a solution of *Epsom* salts in water, which by an agreement of properties, whence the identity of concretes are determined, gave us a demonstration of their sameness. It might indeed have been proved by crystallizing the liquor, and reproducing *Epsom* salts from a combination of its elementary parts, without comparing them as above; but this method is too tedious.

Sal martis and *Glauber* salts having no body wherewith they can be united, which may not be discovered by the methods already laid down, a further account of them is unnecessary.

The principal part of the proposed design then, thus compleated; and the theory of Chemistry, established upon a species of attraction unknown, or unacknowledged at least, by the natural philosopher, shewn capable of being applied to advantage in proving the genuineness of several preparations; whence alone the physician

physician can be secure of success, and the individual preserved from accident; it only remains to insert the specimen or plan of a synopsis, exhibiting at view the constituent, characteristic, and other circumstances requisite in our trials; or so much of them as may be needful in the investigation of chemical productions; or of *Galenic*, where they can be examined from chemical truths: and of disposing the substances in the most suitable manner for the benefit of novitiates, and ease of adepts.

An alphabetical disposition, should our method of enquiry be thought worthy of attention, seems most eligible at present, for several reasons, besides the following, which we cannot stay to recount. If attempted to be ranged, according to their affinities, or subordinate attractions of some of their parts, the scheme would be liable to great objections, considering the difficulty of ascertaining these subordinations to any tolerable degree of certainty. And the various means of reducing the same medicine, where chemical attractions do not prevail, as in powdery substances, which only admit of mechanical mixture, if we may be allowed to insert them in a chemical treatise, is an obstacle hardly to be surmounted. In the subsequent table,

table, therefore, insignificant as it is, an alphabetical order is preferred; and though of no consequence in this place, it may chance to have its use in a more ample catalogue.

The trouble attending an enquiry into as many shop articles as chemistry is able to compass, if accurately performed, through different contrivances of sophistication, will be very sufficient, without the additional care of framing a new method, neither unexceptionable perhaps, nor free from obscurity. The reader then, it is hoped, will have candour enough to overlook a nicety, which might indeed have been very well dispensed with, and impute this step to the fear of omitting any serviceable hint, rather than to an extravagant fondness for trifling.

The

The PLAN of a chemical SYNOPSIS, and easy method of examining substances for the use of medicine, with the several results of each genuine preparation; deduced from the experiments themselves, and according to, upon a species of attraction peculiar to each science.

<i>Names of the Medicines.</i>	<i>Descriptions.</i>	<i>Chemical Characteristic.</i>	<i>Methods of Trial.</i>	<i>Results, &c. of Genuine.</i>
Cinnab. fact. or vermillion.	A bright red substance, consisting of sulphur and mercury sublimed.	Volatility.	Exposing to strong heat.	Diffipation, with very little if any remainder, p. 137.
Mag. alb.	A light earthy body, very white, when pure, and extremely soft.	Union with acids, hence neutral salts; and with the acid of vitriol, a true <i>sal cath. amar.</i>	Neutralizing in a slight vitriolic acid.	A saline liquor, similar in all respects to a solution of <i>Epsom</i> salts in water, p. 149, &c.
Ol. anif. chem.	A volatile odorous, oily substance, drawn from the seeds of the plant.	Miscibility with oils, oily bodies, and alcohol; and volatile in the heat of boiling water.	Adding a little alcohol.	Complete solution of each, so as to form a fluid apparently homogeneous, p. 139.
Sal martis.	A crystalline salt, constituted of vitriolic acid, calx of iron, and water.	Divisible by fire into coleothar and oil or acid of vitriol.	Immerging clean plates of iron into a saturated solution of it.	No alteration in the menstruum, p. 145.
Sal mirabile. <i>Glaub.</i>	A neutral purging salt, from a combination of fossil alkali and vitriolic acid.	Soluble in an aqueous menstruum, and indestructible by a fusing heat.	Adding a little of the lixivium tartari to a saturated solution of it.	No immediate sensible separation, p. 142.

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